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ABSTRACT

This book discusses computer coordinator responsibilities and suggests necessary qualifications. The need for computer coordinators is discussed and responsibilities of a building-level computer coordinator are identified to help distinguish this position from that of a computer teacher. A more detailed analysis of the types of activities that might involve a computer coordinator provides an overview of computers in instruction and discussions of the computer coordinator as a computer scientist, a learning specialist, and as a computer-integrated instruction specialist. A summary of computer coordinator responsibilities and planning and implementation is included, as well as a categorization of possible qualifications for a coordinator; a list of technical qualifications for a masters degree in computer education; discussion of the nature of many computer coordinator positions and how these are filled; an examination of some of the problems currently faced by computer coordinators; an analysis of the importance of educational goals in relation to educational computing; and interviews with six computer coordinators. Five references and two periodicals are listed, and two editorial reprints from The Computing Teacher are provided: "The Two Percent Solution" (edited) and "Back to Basics." (LMM)

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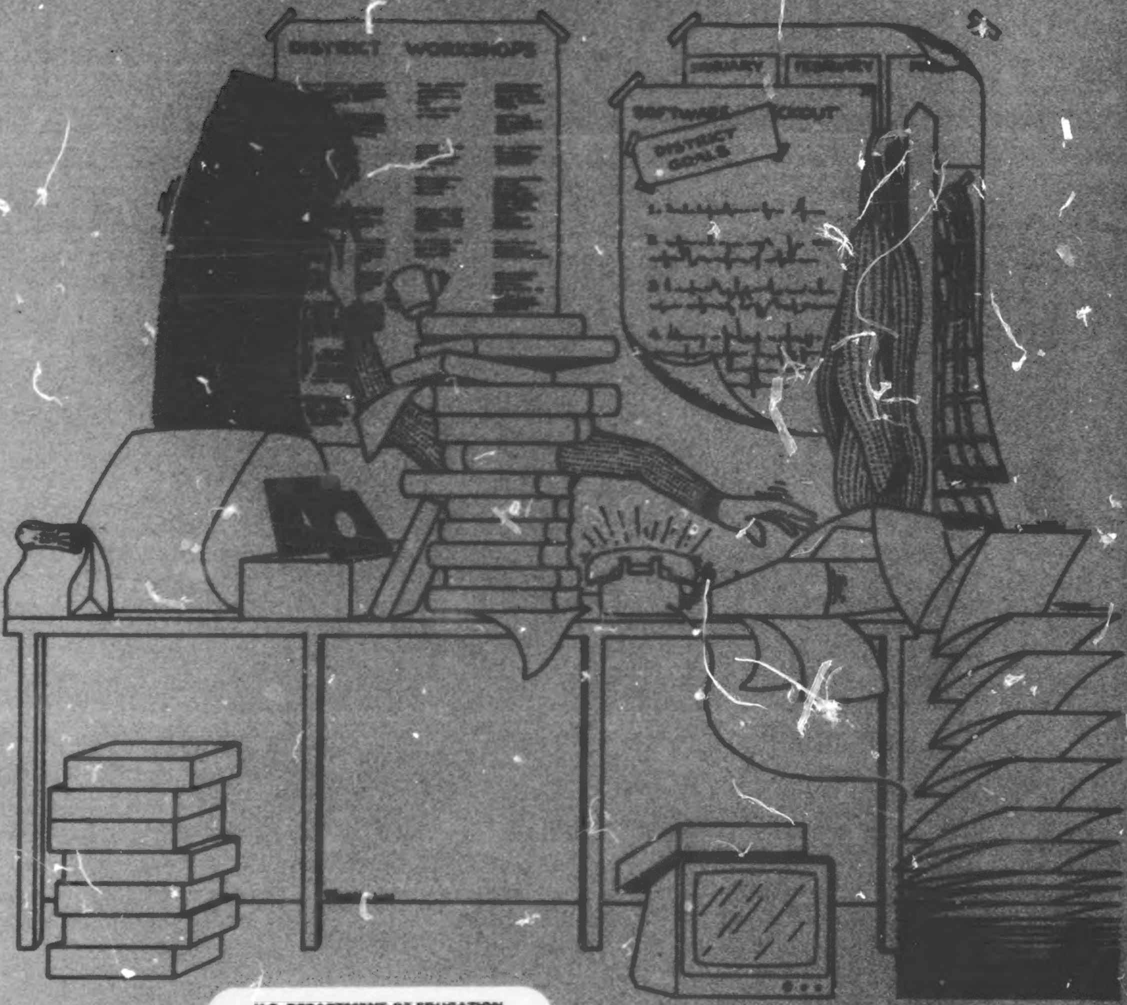
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- Chairman of the Association for Computing Machinery's Elementary and Secondary Schools Subcommittee, 1978-1982.
- Chief Executive Officer of the International Council for Computers in Education and Editor-in-Chief of *The Computing Teacher.*

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The Computer Coordinator

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Preface

In 1837 Samuel Morse applied for a patent on an electrical, key-actuated telegraph system. It made use of a code he had developed about five years earlier. Public use of Morse's electrical telegraph system was inaugurated on May 24, 1844 with the message "What hath God wrought?" being sent between Baltimore and Washington. One can argue that this was the beginning of a major educational revolution that is still continuing.

The revolution we speak of is based upon electrical and electronic communication and computers. It may be compared to changes wrought by books, and certainly it has some similar characteristics. Books allow the storage of information over time and the transmission of information over distances. Books have changed the basic nature of education and of our world.

The telegraph, telephone, radio, television, tape recorder, video recorder and other modern aids to communication also allow the storage of information over time and the rapid transmission of information over distances. And now we have the computer, further increasing the ability of electronic systems to store and transmit information.

Computers add a new dimension, since they allow information to be processed. Not only can one store information about solving complicated problems, one can store computer programs that can actually solve or help solve the problems. The computer has brought with it the idea of an effective procedure— a procedure that can be carried out by a computer. This will probably be one of the most important contributions to human intellectual activity of all time.

As computers become cheaper and more readily available, educators are asking three basic questions:

- What should students learn about computers?
- How can computers help students to learn?
- How should computer use affect the content of non-computer subjects (computer-as-tool)?

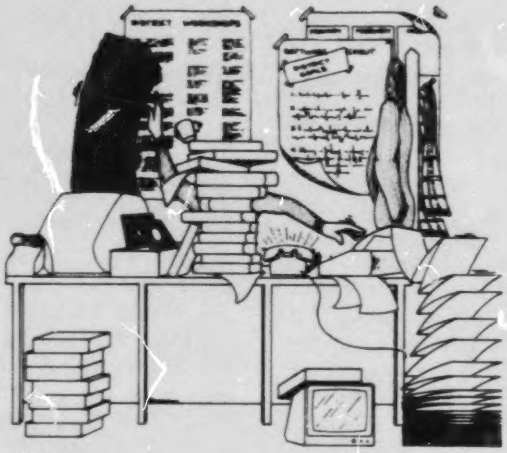
These are very difficult questions, and answers change over time. But parents, students and educational leaders want answers now!

Computer coordinators at the school building level and at the school district level are being expected to develop and implement answers to the three difficult questions. They have been cast in the role of leaders; they are asked to play a significant part in a major revolution that is sweeping our educational system.

This book is for people who are currently computer coordinators or who are thinking about becoming computer coordinators. It is also for school administrators who are exploring the possibility of creating computer coordinator positions and hiring computer coordinators. The book analyzes computer coordinator responsibilities and suggests needed qualifications. It also examines the nature of many current computer coordinator positions; a number of interviews with computer coordinators are included.

Many of the ideas in this book were first presented in my graduate seminar in computer science education during the summer of 1984. Feedback and suggestions were received from about a hundred educators, many of whom hold computer coordinator positions. To all of you I say "Thanks." I have attempted to preserve the anonymity of the computer coordinators I interviewed. To them also, I say "Thanks."

Dave Moursund
November 1984



Chapter 1
Introduction

The amount of computer hardware, software and support materials available for instructional purposes in our schools is large and still growing very rapidly. Many school systems have set goals and are working on long-term plans to accomplish the following:

- All students should become functionally computer literate.
- Computer-assisted learning should be used when it is educationally and economically sound. This includes computer-managed instruction as well as aids to the teacher such as computerized gradebooks.
- The computer-as-tool should be integrated into the entire curriculum, both as an aid to problem solving and as a potential source of problems. The computer should be readily available as a tool of both students and teachers.
- Secondary school courses in computer applications, computer programming and computer science should be available to students who need such coursework to prepare for a career or additional schooling.
- Each individual school should have an instructional computing plan that is consistent with the district plan and fits the needs of the individual school.

Most school districts now offer a wide variety of computer-related courses and are making increasing use of computer-assisted learning. The use of computer-as-tool is now widely accepted and increasingly is set as a goal for all students and as the dominant long-term goal. It has become clear that nearly all teachers will eventually need to have some involvement with computers. Out of this overall growth and planning have emerged three general categories of educators seriously involved with instructional computing.

- Classroom teachers of non-computer topics (computer-using educators)
- Computer teachers
- Computer coordinators

The regular (non-computer) classroom teacher must cope with students who are becoming increasingly computer literate. The teacher must deal with the computer as an aid to instruction and the computer as a tool of both students and teachers. In many elementary schools the regular classroom teacher may also be expected to provide the initial computer instruction to students. Such teachers may be expected to provide introductory instruction in keyboarding, use of computer-assisted learning materials, word processing, and perhaps even in use of Logo.

However, our educational system is based upon subject matter specialization, especially at the secondary school level and higher. Even in an elementary school we may well have an art teacher, a music teacher, a library media specialist, a talented-and-gifted teacher and a resource room teacher. Some elementary schools now have a computer teacher.

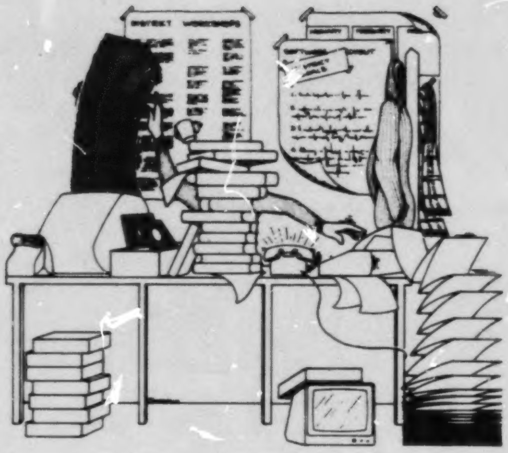
At the secondary school level, an increasing number of teachers spend half or more of their time teaching computer literacy, computer programming, computer science and computer application courses. Some secondary schools have a computer science department.

This book is specifically concerned with the third category of educators, computer coordinators. Many schools have designated one of their teachers as the building-level computer coordinator. (This person may also have duties as a non-computer classroom teacher or as a computer teacher.) Many school districts have designated a person as district-level computer coordinator. Many educational service districts or intermediate educational districts have a computer coordinator. A number of states have established technical centers; a computer coordinator may be employed by a technical center.

Thus, a large and growing number of people hold the position (if not the title) of "instructional computer coordinator" at a school, school district or some other level. An instructional computer coordinator, hereafter referred to as a computer coordinator, should not be confused with the head of administrative data processing. The qualifications needed to be a successful (instructional) computer coordinator are substantially different from those needed to be the head of a school district's administrative data processing program. Indeed, it is quite unusual for these two positions to be combined and to be simultaneously filled by one person. The general ideas presented in this book suggest that such a combining of job responsibilities is undesirable.

The analysis in this book leads to some rather lengthy lists of possible responsibilities of building-level and district-level computer coordinators. These lists are analyzed to provide a rationale for a set of recommendations on the preparation of educators who seek computer coordinator positions. These recommendations can help guide educators who are preparing to hold a computer coordinator position or who already hold such a position. Alternatively, the recommendations can help a hiring committee to select a person who is suitably qualified to be a computer coordinator.

This book is designed for easy reading. Most people will be able to read it from cover to cover in a few hours. Some people may want to read the interviews section first. The interviews give considerable insight into the computer coordinator position and the type of people who successfully fill this position.



Chapter 2
The Need for Computer Coordinators

Many school districts, states and provinces have made a serious commitment to substantial and increasing instructional use of computers. It is difficult to obtain reliable, current statistics on the number and nature of the pieces of computer equipment in schools and their total dollar value. Similar difficulties exist with attempting to inventory the software and support materials used in schools. However, it is likely that by the end of the 1984-85 academic year there will be approximately 750,000 "stations" (single-user microcomputers and/or terminals to time-shared systems) available in precollege schools in the United States. This will be approximately one station per 60 students. The use of the terminology "station" rather than microcomputer is important since time-shared microcomputer systems may become increasingly important in the school environment.

It is reasonable to guess that the number of stations of computer facility available in schools will double or triple during the three-year period 1985-88. Some projections suggest a doubling each year, while others suggest a plateau will soon be reached. Continued long-term growth in computer availability for the next 10 to 20 years seems very likely. Quite a few schools now have a ratio of one station per 10 students, and a few schools have a ratio of one station per two students. Ten years from now many schools will probably have one station per two students, and some schools will have one station per student. By 20 years from now one station per student may be a common situation.

In any event, the available computer equipment is not evenly distributed among the grade levels or among school districts. Thus, for example, there are school districts that have one station per 20 students, and there are other school districts with a ratio of less than one station per 200 students. Many school districts have concentrated their computer equipment into their high schools; some elementary schools still have no computer equipment.

If a school has a very small amount of computer equipment, this equipment is apt to reside in one or two teachers' rooms and be controlled by those teachers. Generally, the teachers do not think of themselves as computer coordinators and do not have such a title. However, they carry out many duties of a computer coordinator.

Many schools now have a computer lab which is used by a variety of teachers and students. Indeed, many secondary schools now have 50 or more stations. These may reside in several labs, with a few additional single-user microcomputers distributed among a number of other classrooms. Often one person is in charge of these computer labs, and therefore is performing a number of computer coordinator duties.

It is not just the total quantity of computer equipment in a school or district that determines if a computer coordinator is needed. Perhaps a more important factor is the nature and extent of equipment use. For example, consider a school with 40 teachers, each teacher having a single-user microcomputer for personal word processing, computerized gradebook and similar purposes. Each classroom might be equipped with monitors or a projection television system to allow computer demonstrations to the whole class. Each teacher maintains a small set of software for personal use, and each teacher has a budget for the purchase of software. Each teacher has received appropriate inservice or preservice computer-oriented education to deal with an in-class computer system. If a computer needs repair, the teacher calls the district computer repair office. Such a school might not need a computer coordinator.

An alternate arrangement of the 40 microcomputers might be to place 25 in a "typing" classroom and 15 in a library. All machines are dedicated either to word processing or to the teaching of word processing skills. The machines used for teaching word processing are under the control of a typing teacher. The machines in the library are under the control of a library media specialist. In both cases the machines are treated much like typewriters. The school could well believe it does not need a computer coordinator.

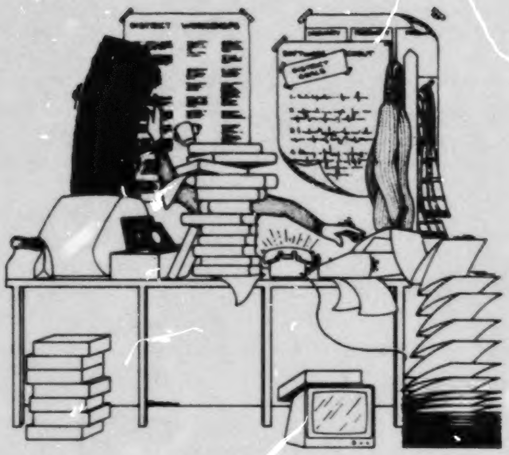
Contrast this with a smaller school having just 25 microcomputers, but all placed into a computer lab. These might be networked to a hard disk. The school has a goal of giving every student a substantial amount of hands-on computer experience as part of a wide variety of non-computer courses such as social studies, composition and mathematics. Thus, entire classes are scheduled into the computer lab at various times during the school year. This example differs from the 40-station school example in two major respects. First, the machines are concentrated in a lab used by a number of teachers; someone must be responsible for the lab. This includes scheduling the lab, maintaining the equipment, caring for the software collection, and other similar activities. If a hard disk system is used, someone must do the system backup and be in charge of the overall system. Second, a number of teachers are actually making substantial classroom use of computers, with their students gaining a variety of useful computer skills. The burden placed upon these teachers is such that they need the support of a computer coordinator. The coordinator might aid in teacher training, development of units of study, software acquisition, and other similar activities. The coordinator coordinates the development and implementation of the school computer education plan.

A similar type of analysis can be used at a school district level. A school district could well have several hundred single-user microcomputers distributed among its schools. There might be a designated computer teacher in each school building, with a committee of such people doing district-level planning. Such a district might not feel it needs a district-level computer coordinator. Rather, a district-level curriculum coordinator might meet regularly with the computer committee, but do little else in regards to filling the role of a computer coordinator. Alternatively, responsibility for planning and coordination of computer usage might be concentrated at the district level, with one person designated as the district's computer coordinator.

For the March 1984 issue of *The Computing Teacher,* I wrote an editorial titled "The Two-Percent Solution." The editorial is an analysis of how a school district might spend two percent of its annual budget in the instructional computing field. It suggests that half of the money might be spent for hardware. A considerable amount would be spent for software and for support staff. A school district with 10,000 students has a budget of perhaps $25,000,000 per year. Two percent of this is a half million dollars per year. Annual expenditures in that range can certainly justify and support computer coordinator positions at the district and school building levels. Over the long run we may find school districts spending considerably more than two percent of their budgets in the instructional computing field. A slightly expanded version of "The Two-Percent Solution" is given in the appendix of this book. It is a valuable planning guide to computer coordinators and school administrators.

As will be seen later in this book, a school system making substantial instructional use of computers is faced by a number of tasks that might be collectively assigned to a computer coordinator. This is true even in a quite small district. The temptation in a small district may be to distribute these tasks to existing personnel, including teachers. But there is quite a difference between the duties that a computer coordinator needs to perform and the duties of a typical classroom teacher. That is, different qualifications are needed to satisfactorily perform these two types of jobs. Chapter 3 discusses this issue in more detail.

There is no simple formula as to when a school or school district needs a computer coordinator. Rather, one should examine the tasks to be accomplished as computers play an increasingly important role in schools. Some of these tasks will become everyday duties of regular classroom teachers. Other tasks will be assigned to computer teachers, media specialists and various school administrators. In most schools and districts, there will remain a large number of other tasks that are best assigned to a computer coordinator. Thus, we can expect that the number of computer coordinators will grow.



Chapter 3

Computer Teacher Versus Building-Level Computer Coordinator

To better understand the computer coordinator situation, we need some insights into possible job responsibilities of a computer coordinator. In this chapter I examine some responsibilities of a building-level computer coordinator to help distinguish this position from that of a computer teacher. Later, in Chapter 8, I give a much longer list of possible responsibilities of a district-level computer coordinator. The two lists overlap, and in a small district a person holding one level of coordinator position may be expected to perform duties at both levels.

In Chapter 1, I considered three categories of educators with possible everyday involvement with instructional use of computers: regular (non-computer) classroom teachers, computer teachers and computer coordinators. At the school building level, it is quite common that a computer teacher (or, less frequently, a regular classroom teacher) is also designated as computer coordinator. But the duties of a computer teacher differ substantially from those of a building-level computer coordinator.

The computer teacher (or, any classroom teacher) is directly responsible for the instruction of students, while a computer coordinator is not. A classroom teacher's main duties involve interacting with students. This requires detailed knowledge of the curriculum to be taught, and it requires good classroom teaching skills. For example, consider an elementary school computer specialist. Such a teacher may be responsible for teaching an introduction to computers, keyboarding skills, computer applications and computer programming to every student in the school. This requires developing a detailed scope and sequence, including daily lesson plans, for what is to be taught at each grade level. It requires working with a wide range of children, and it may require working with several hundred different children during a single week.

Or consider the person who is responsible for teaching the full range of high school computer courses. This could well include teaching an Advanced Placement course using Pascal as well as several other computer programming courses (assembler, BASIC, Logo) and a computer literacy course. Adequate technical preparation for such a range of teaching responsibilities may require roughly the equivalent of a bachelor's degree in computer science. A high level of skill in understanding and teaching structured programming and problem solving is essential.

Now compare this with some possible duties of a building-level computer coordinator. The following list gives some possible duties. A full-time building-level computer coordinator might be expected to accomplish most of these tasks. A regular classroom teacher with no release time cannot reasonably be expected to spend substantial time performing these duties in addition to teaching duties.

- Work with a district-level computer coordinator and other building-level computer coordinators to set district and school goals for instructional use of computers. Work with the same people and with curriculum leaders to develop detailed computer-related instructional objectives.

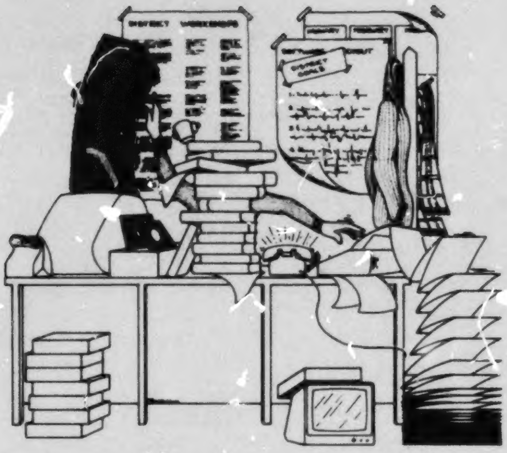
- Work with teachers and curriculum leaders to develop specific building-level plans on how to implement the computer-related goals and instructional objectives.
- Help teachers to develop curriculum materials and specific lesson plans so that they can carry out their part of the overall building-level instructional computing plan.
- Provide informal and perhaps formal computer-oriented inservice education to teachers and school administrators. Train volunteers, paid aides, and some students to be lab assistants. Provide education for parents and other interested adults. Organize a computer open house for parents, with all of the demonstrations and instruction being done by students; this might be done in conjunction with a fund-raising effort.
- Be responsible for the school's computer hardware, software and support materials. This may include acquisition and maintenance of hardware and software, cataloging and checking out software, scheduling and supervising the computer lab, ordering books and periodicals, etc. It may include more mundane activities such as dusting the equipment, putting paper into printers and changing printer ribbons. Be responsible for the school's computer budget.
- Be a resource person, able to respond to a wide range of questions about hardware, software and computer applications in education. Maintain contact with sources of information and/or help, such as computer teachers, computer coordinators, computer-oriented professional organizations and vendors. Keep up on new software; bring this new software to the attention of teachers who might use it.
- Help students, both in a one-on-one basis and in a classroom setting. Here we distinguish between a computer teacher and the computer coordinator who does demonstration teaching or occasionally presents a new product or idea to whole classes. A computer coordinator does classroom demonstrations occasionally, while a computer teacher does this regularly.
- Develop and implement evaluation procedures to assess the overall effectiveness of a school's instructional computing program; make periodic reports on the status and progress of instructional computing in the school.
- Keep up in the computer field by studying, attending conferences, and working with new pieces of hardware and software. Develop and follow a plan for personal professional growth.

Quite a few of the above duties fall into the general category of being a computer facilities manager or director. Such positions have existed in colleges and universities for many years. They are usually filled by people who have held faculty positions and have moved their careers in an administrative direction. This may prove to be a common pattern in schools, but it is still too early to say. Certainly, it is a distinct possibility, as more and more schools establish computer labs. A number of secondary schools already have two or three computer labs and are beginning to be concerned about how to house additional equipment.

In summary, the building-level computer coordinator can be seen to have four general types of duties. These are working as a computer facilities manager, working with school administrators and district-level educators, working with teachers and working with students. The latter activity is often a modest part of the computer coordinator's duties. As compared to a computer teacher, this difference in responsibilities and everyday activities is clear.

However, the classroom teacher versus computer coordinator issue is often confused by having one person fill both types of positions simultaneously. Currently that is the most common situation in schools that have a designated computer coordinator. The responsibilities of being both a computer coordinator and a classroom teacher are large. It is difficult to be a well-qualified classroom teacher, and it is difficult to be a well-qualified computer coordinator. To be both simultaneously is particularly difficult, even if one's teaching assignment is to be a computer teacher. Some release time from teaching responsibilities is essential. Also, it is essential to have a clear specification of one's computer coordinator duties. Otherwise one is apt to be severely overworked and face the possibility of burnout.

In the remainder of this book, I will more carefully examine responsibilities of a computer coordinator. Insight is sought into needed qualifications of a computer coordinator, especially at a district level, and these qualifications should not be confused with needed qualifications of a computer teacher. I will assume that the analysis in the current chapter precludes an assertion that a computer coordinator must have exactly the same computer-oriented qualifications as a computer science teacher. However, the computer coordinator may have to do demonstrations or guest lectures. Also, generally a person must be a certified teacher to obtain a position as a computer coordinator. Finally, one very effective mode of doing teacher inservice is to model the desired end behavior (that is, model the teaching of school children as part of the process of teaching teachers). Thus, classroom experience as a teacher of computer courses and/or as an instructional user of computers is a highly desirable qualification for a computer coordinator.



Chapter 4
Overview of Computers in Instruction

The previous chapter contains a list of some possible building-level computer coordinator responsibilities. In this and the next few chapters, I give a more careful analysis of the types of activities that might involve a computer coordinator. This analysis applies both to building-level and district-level computer coordinators. It provides a foundation for the long list of possible coordinator responsibilities given in Chapter 8.

The overall field of instructional use of computers may be divided into learning/teaching **about** computers, learning/teaching **using** computers, and learning/teaching **integrating** computers. Each component of this three-way model of instructional computer use emphasizes that both students (learning) and teachers (teaching) are essential. The model differs slightly from and is a little more general than the "tutor, tool, tutee" model popularized by Robert Taylor.

A computer coordinator holds a leadership position, interacting with classroom teachers, curriculum specialists and school administrators. This leadership position involves all three major components of instructional computer use. This chapter defines the three components while the next three chapters examine the components from a computer coordinator point of view.

In learning/teaching about computers, computer science, along with related areas such as information science and data processing, is considered as a subject area. Schools make a decision to teach this subject area. They sometimes express this decision as a goal that all students should become computer literate or that some students should be given preparation to take a computer science advanced placement exam. At other times they specify a list of courses that are to be taught, such as various programming languages, an advanced placement course, a robotics course, or an electronics course.

It is important to realize that computer-related disciplines are now well established even though they continue to grow and change rapidly. The Association for Computing Machinery, for example, is a large professional society that began in 1947. The ACM Curriculum '68 specified details of a college undergraduate curriculum of study. Those recommendations were updated ten years later, in Curriculum '78. Other college-level curriculum recommendations have been developed by the Computer Society of the Institute for Electrical and Electronic Engineers, and by the Data Processing Management Association. Both of these organizations are large professional societies of people interested in the computer field.

At the two-year college, four-year college and university levels, computer science departments have existed for 10-20 years and more. There are hundreds of associate and bachelor degree programs. In North America there are about a hundred doctorate programs in computer science. There are hundreds of research journals as well as a great many popular periodicals carrying computer-related articles.

Because computer science is such a large and well-established discipline, schools must decide what aspects of the discipline to include in their curriculum. Computer coordinators help make such decisions.

In learning/teaching using computers, the concern is the overall instructional delivery system. One can examine computers as aids to the teacher. The use of a computerized gradebook, a computerized data bank of exam questions, a computerized information retrieval system, or even a word processor are all good examples. Generally speaking, the role of a computer coordinator here is to encourage such computer use by helping to provide appropriate hardware, software and teacher training. Since such computer use may simplify the teacher's job, it is a good way to get teachers hooked on computers.

Learning/teaching using computers also includes all aspects of computer-assisted learning, such as computer-assisted instruction and computer-managed instruction. In Chapter 6 we will more carefully examine the role of a computer coordinator when the computer is considered as an instructional medium. A computer might be used in a supplementary mode, with students making a modest use of computers to reinforce instruction provided by other means. Research into computerized drill and practice suggests that this mode of supplementing instruction is quite effective in a variety of subjects. For some students and/or in certain subject areas, a computer might be a primary mode of instruction. This type of usage seems highly likely to increase in the future.

The computer can be used for instructional delivery at every grade level, in every subject area, and with all types of students. Evidence is mounting that computers are especially useful in special education. The use of a computer to help prepare an IEP (individualized educational plan, for a handicapped student) and the delivery of instruction prescribed in an IEP are both part of learning/teaching using computers.

In learning/teaching integrating computers, the computer is considered as a tool in the various academic disciplines. The emphasis is upon learning to use computer application packages and integrating them as everyday tools into a student's overall knowledge and skills. We shall call this *computer-integrated instruction* (CII). Standard examples of CII software include word processing, graphics, spreadsheet and data base.

A very simple example of computer-as-tool is provided by the hand-held calculator. Progress in incorporating calculators into the curriculum has occurred, but it has been slow. One difficulty is that the established curriculum, backed up by teacher knowledge, curriculum materials and standardized testing, is quite resistant to change. Many potential tool uses of computers face similar resistance, and a computer coordinator must deal with this resistance.

Progress in developing better and more applications packages and better person-machine interfaces is causing CII to grow rapidly. Also, computer scientists working in the field of artificial intelligence are producing application packages that can solve a variety of difficult problems—problems that are generally considered to require a substantial amount of knowledge and skill. Such packages may eventually change the content of a variety of school subjects. The key issue is what students should learn to do mentally, what they should learn to do assisted by simple aids such as pencil and paper or book, and what they should learn to do assisted by more sophisticated aids such as computers and computerized equipment.

Each of the three general categories of instructional use of computers can be analyzed to determine possible duties and needed qualifications of a computer coordinator. That is done in the next three chapters.

DISTRICT WORKSHOPS
PRIMARY
DISTRICT GOALS

Chapter 5

Computer Coordinator as Computer Scientist

One way to analyze the computer coordinator position is as a subject matter specialist position. In that sense the position is similar to being a subject matter coordinator or specialist in mathematics, music or some other subject area. Indeed, a person may even hold the title of computer science specialist, although this rarely occurs. At the school building level, the analogous position is that of a subject matter department chairperson.

The analogy with other subject matter coordinators or specialists is useful, since we know a lot about the types of qualifications a subject matter specialist should have. Specifically, such people are expected to be quite competent within their subject matter areas. A district subject matter specialist is generally a person who has been a successful secondary school teacher in that subject and who holds at least an education-oriented master's degree in that content area. The subject matter specialist is a curriculum leader, often playing an important role in the setting of goals, the selection of materials, the design and implementation of new courses, and the inservice education of teachers.

One important responsibility of a subject matter specialist is facilitating communication between experts or practitioners in the subject matter (from higher education or the labor market community) and the school district's teachers and curriculum. A computer coordinator must have enough technical knowledge to understand what the literature and experts are saying and translate it into terms meaningful to precollege educators. The computer coordinator must be a curriculum leader, helping to make sure that appropriate computer-oriented ideas are included in the curriculum.

Another important responsibility of a computer coordinator is addressing the articulation problem, that is making sure that the curriculum at one grade level meshes with the curriculum at other grade levels. This is a problem for both district and building-level computer coordinators. An elementary school computer coordinator must deal with the articulation problem between the elementary school curriculum and the general secondary school curriculum; also, articulation with the secondary school computer science curriculum is important. Right now this seems to be a particularly difficult problem at the elementary school level. Some students are receiving introductory keyboarding and introductory Logo year after year. The problem is compounded by home computers and computer camps. Many young students know more about computers than do their teachers.

The articulation problems have received relatively little attention, although the problems are growing. Suppose that an elementary school gives students instruction in keyboarding, word processing and Logo programming. How will this fit in with the computer-oriented aspects of the junior high school curriculum? Suppose that a junior high school teacher uses an historical simulation and a stock market simulation that are also being used in the high schools. How will students react to later encountering these simulations again? Many high schools teach programming in BASIC. Colleges often complain that such courses may even have negative value in preparing students to handle the freshman computer science sequence that is based on Pascal. Understanding and coping with such problems requires both general curriculum knowledge and computer-oriented technical knowledge.

At whatever the level, the computer coordinator is faced with a rapidly growing and changing body of computer science knowledge. As an example, consider an elementary school computer coordinator. A few years ago a general overview of computer literacy plus a knowledge of programming in BASIC might have been considered sufficient computer science knowledge. But then came microcomputers (lots of hardware in the school) and Logo (kids and teachers dealing with computer programming and discovery-based learning). Now data base systems, telecommunications, robots and perhaps even new "higher level" programming languages such as Prolog may be coming into the elementary school curriculum. (Prolog has been tried with a variety of fifth and sixth graders with some success. It is a language designed for use in artificial intelligence programming.) The elementary school computer coordinator must cope with this type of change in elementary school computer-oriented curriculum content.

Or consider a programming teacher at any level. Many years ago the general approach to teaching programming was to assume that students were good at problem solving and therefore to concentrate on syntax and semantics. This approach worked fairly well in teaching mathematics, science and engineering graduate students how to program in FORTRAN. Now, of course, we realize that the majority of effort in teaching/learning computer programming must be in the problem-solving domain. This is especially true as we attempt to teach programming to younger and younger students. The computer coordinator must help the school and school district to design appropriate courses to fit the needs of students at all levels.

The Advanced Placement (Pascal) course provides still another example. The content of the AP exam is drawn from roughly the first year-and-a-half of a solid college sequence for computer science majors. While the language Pascal is used as a vehicle, the main emphasis is upon problem solving, control structures, data structures, top-down analysis, machine architecture and other general ideas from computer science. These are ideas that may not be familiar to the typical self-taught secondary school computer teacher. Indeed, they were not familiar to many college computer science teachers a dozen years ago. The computer coordinator has a responsibility of ensuring that computer courses incorporate modern content and ideas.

Changes in the definition of computer literacy over the past dozen years provide another example. Initially computer literacy referred to an awareness or talking-level of knowledge. A student needed to know some vocabulary and be aware of various computer applications. But most schools did not have sufficient computer facilities to provide much hands-on experience. Then came inexpensive time-shared systems, and computer literacy began to mean elementary programming skills in BASIC. This continued with the proliferation of microcomputers. Next came some good application packages for microcomputers. Now computer literacy is placing ever increasing emphasis upon developing a functional level of skill in using word processing, data base systems, graphics packages and spreadsheets. Use of this functional computer literacy can be integrated into the entire curriculum. Computer coordinators must lead their schools and districts in coping with such change.

It is easy to expand the list of computer science topics and ideas that could well make their way from college curricula into precollege curricula. We mentioned robotics; a number of secondary schools now offer courses in this area. Perhaps a robotics course is a very good way to help students gain some of the computer programming aspects of computer literacy? And robotics is but one aspect of artificial intelligence. Might a secondary school computer course contain a substantial unit on artificial intelligence? This is often recommended as part of a high school computer science course.

Some computer science topics coming into precollege education fall under the province of non-computer teachers. Recent advances in computer graphics are quite important in commercial art and in industrial drafting. Computer aids to music composition or to the synthesis of music may be important in secondary school music courses. Progress in telecommunications and information retrieval might be important content in a social studies course. All of these examples are relevant because the highly technical nature of the computer field makes it difficult for teachers in art, music and the social sciences to understand changes that might be important in their disciplines. The computer coordinator can help bridge this gap.

The need to help non-computer teachers learn about computer science and incorporate computer ideas into their courses seems evident. This places a responsibility on computer coordinators that is not usually faced by subject matter specialists in other areas. There are analogies, however. A writing specialist would like all teachers to be writing teachers. Thus, a writing teacher may give workshops for science, math and health teachers, to help them become writing teachers within their own disciplines. The Bay Area Writer's Project is based on that philosophy. The analogy is weak, however, since all teachers are writing literate at a functional level.

The issue of how school curriculum should relate to the job market is somewhat controversial. Some school districts place more emphasis than others on helping students to gain marketable skills. Such schools may have been early leaders in preparing some of their graduates for entry-level jobs in the computer industry. At one time a high school graduate with good keypunching skills could step into an entry-level keypunching job. But the field has changed, and keypunching is a declining occupation. Keyboarding and word processing skills are now in demand. Similarly, at one time some vocationally-oriented high schools offered data processing courses that prepared students for entry-level programming jobs. The job potentials for students with this type of high school training are declining.

The analysis given in this chapter leads to the conclusion that a computer coordinator needs to know quite a bit of computer science. The nature and extent of needed computer-oriented technical background, however, is not clear. Certainly, it must be sufficient to understand major changes that are occurring or will occur and that may affect the precollege computer-oriented curriculum. And part of the need may be created by the computer teachers in the district. If the computer coordinator is viewed as being a computer curriculum specialist—in some sense as being in a position over the computer teachers--then the computer teachers may expect the computer coordinator to have a high level of technical knowledge. We will return to the topic of technical knowledge of computer coordinators in Chapter 10.

This chapter also indicates that a computer coordinator must be good at facilitating communication and joint planning between educators and practitioners at a variety of levels. This requires good learning skills and good communication skills. A computer coordinator may have to develop and teach (or, cause to be developed and taught) a wide variety of inservice courses designed to help educators learn about computer science. Finally, a computer coordinator may have curriculum planning duties, often working both with computer teachers and with a wide variety of teachers who have only a modest amount of computer knowledge. This requires good knowledge of curriculum, of curriculum development, and of change processes in education. It requires good skills in working with people.

Chapter 6

Computer Coordinator as Computer-Assisted Learning Specialist

Computer-assisted learning can be thought of as an attempt to computerize certain important aspects of the overall learning/teaching process. It is an attempt to make learning/teaching into a science. If education were a science, then the results of applying a particular instructional treatment to a particular student would be accurately predictable. We would be able to determine optimal sequences of instruction for each individual student.

Most people tend to consider the overall process of education as an art rather than a science. But there is a field of study and research called learning theory; there is also a field called teaching theory. Both learning theory and teaching theory are supported by substantial research and have slowly accumulated significant results. Some of these results are used in the method of teaching known as *direct instruction*. Direct instruction has proven quite effective in the "head start" program used with disadvantaged preschool children. More generally, we now have good evidence that students can learn better and faster if results from learning and teaching theory are incorporated into the overall learning/teaching process.

The vehicles for conveying or making use of learning/teaching theory are a combination of the learner, the teacher, and the instructional media and environment. The latter includes media aids such as books, films, laboratory equipment, and so on, as well as the general design of facilities.

This simple three-part model of learning/teaching suggests a three-pronged attack to improve education. Education can be improved by helping students learn how to learn. Give them practical implementations of the best results in learning theory, and they will learn better and faster. The use of "chunking" and mnemonics in memorization provide examples. As another example, we know that different students have different dominant learning modalities. Some students learn best by seeing; others learn best by hearing or by doing. Students can learn to take advantage of their dominant learning modalities as part of learning how to learn.

Similarly, teachers can learn to make use of teaching-theory ideas. A new idea can be introduced by using a carefully selected collection of examples and non-examples. Appropriate models of reinforcement can be used to increase learning rates. Review cycles can be better designed by appropriate use of models of forgetting. The instructional media/environment can be improved by incorporating instructional materials and other ideas designed to take advantage of the accumulated results in learning/teaching theory.

It is easy to pick out a weak link as our educational system attempts to implement ideas suggested in the above analysis. Most teachers tend to teach in the way they were taught. They do not have the time and energy to keep up with research in learning/teaching theory. Consequently, progress in learning/teaching theory is only slowly translated into changes in classroom behavior of teachers.

It is often suggested that the desired educational progress can occur by working through the instructional materials and instructional environment. Incorporate the latest learning/teaching ideas in the books, films and other instructional materials. Make use of language labs; equip science labs with the latest scientific instrumentation facilities. The past several decades have seen substantial efforts to do this. These efforts have titles such as language labs, new math, math manipulatives, teaching machines and educational television. Textbooks are now much more colorful and entertaining; programmed texts have come and gone.

The difficulty in making a major improvement in our educational system through changing instructional materials and environment is evident if one examines the attempts of the past several decades. Our educational system is massive, and it is massively resistant to change. Federal legislation backed up by substantial funding can help, as is demonstrated by PL 94-142 in the area of special education. But even educational television, which has received considerable funding over the years, has been able to do little to overcome the educational system's resistance to change. Attempts to improve the educational system through designing better textbooks are confronted by realities of the marketplace. Many major publishers are unwilling to publish really innovative textbooks; many school systems are unwilling to attempt to use really innovative textbooks.

And now, of course, it is suggested that computer-assisted learning is the answer. CAL can be viewed as a combination of media. It has features of books, television, teaching machines, student-controlled manipulatives, and teachers. It has been developed, researched and implemented over a long time span. Perhaps CAL is powerful enough to allow effective implementation of what is known about the overall learning/teaching process? Many people believe this to be the case and are pushing quite hard for increased use of CAL in our schools. Thus, the computer coordinator must interface between the dreams and realities of CAL.

While the formal research and development of computer-assisted learning materials has been going on for more than 30 years, progress has been slow. Consequently, the proper selection of hardware and software, the development of appropriate supportive curriculum materials, the integration of CAL into the overall instructional delivery system, and the training of teachers to make effective use of CAL are all still quite difficult tasks.

The increasing use of CAL may lead to a school or district creating the position of CAL specialist. There are hardware decisions to be made and hardware to be purchased, housed and maintained. Software decisions need to be made, and software must be purchased, stored and maintained. Teachers need to be trained in effective use of CAL materials. The student use of CAL needs to be integrated into the rest of the overall instructional delivery system. If there is no CAL specialist position, all of these duties may be assigned to a computer coordinator.

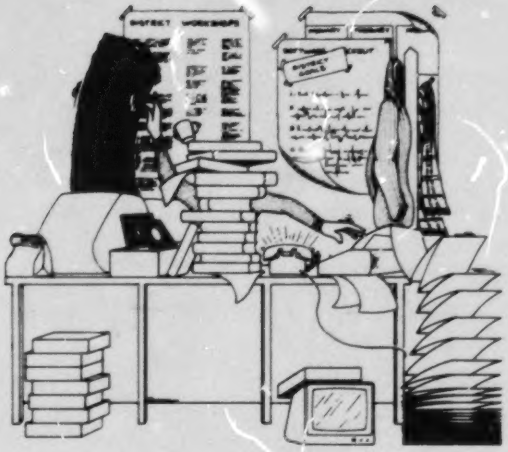
It seems evident that CAL use of computers is in its infancy and that the period of most rapid growth still lies ahead. Schools currently making substantial use of CAL may schedule their students for 10-20 minutes of computer time per day. Eventually (20 years from now, perhaps) we could expect that the typical student might make use of CAL for an hour or two per day, or even more. That will require an immense amount of hardware, software and teacher training. With that amount of CAL usage, the nature of teachers' jobs begins to change significantly. The CAL specialist must work with both hardware and software vendors in helping schools to acquire appropriate hardware and software. In addition, the CAL specialist must work with teachers in all disciplines and at all grade levels, helping them learn to make effective use of CAL. The latter requires considerable knowledge as a curriculum generalist, suggesting one important qualification for a computer coordinator.

The technology of CAL is still changing, as can be seen by examining the current status of videodisc-based CAL. Videodisc-based CAL is a melding of computer and television technology; it may also include touch screen, joystick, mouse or even voice input. While videodisc hardware, software and coursewear are now reasonably priced and fairly reliable, little usage occurs in the schools. The precollege computer coordinator working in this area is still a pioneer and must be a super salesperson. We are all aware of the successes and failures of television as an instructional medium; will videodisc-based CAL go the same way?

Eventually CAl may significantly change the roles of classroom teachers. Indeed, since use of CAL outside of the school setting will grow rapidly, the basic nature of our school systems may need to change. This is threatening to many teachers and may lead to a confrontation between those who support use of this instructional medium and those opposed to such technology. The CAL specialist must understand change processes in the labor environment and especially in education. The increasing potential of CAL could well lead to teacher strikes.

CAL may prove to be the major vehicle for the eventual integration of computers as an everyday tool in the curriculum. As CAL materials improve, it will become harder and harder to distinguish CAL from computer-as-tool. For example, a program designed to help teach graphing will be able to do graphing. A program to help students learn grammar will be able to determine grammatical errors and make suggestions for changes. A music program for ear training may be useful in musical composition.

Eventually all teachers will learn to cope with CAL. They will have used CAL while in school, and they will have studied CAL in their college media and methods courses. As this gradually happens over the next few decades, the role of computer coordinators as CAL specialists will change. But meanwhile, this may be one of the major parts of a computer coordinator's job.



Chapter 7

Computer Coordinator as Computer-Integrated Instruction Specialist

Computer-integrated instruction (CII) is the integration of computer applications (computer-as-tool) into the content of the overall school curriculum. A parallel is sometimes drawn with reading, writing and arithmetic. Each is a discipline in its own right, and all students study these disciplines. But each is a tool useful in studying and learning to attack the problems of practically any academic area. Thus, our school system works hard to ensure that all students develop basic competencies in reading, writing and arithmetic so that they will have the skills needed to use these tools in all disciplines.

It is important to realize that tools themselves contribute to the various disciplines. Because of computers and telecommunications, we have computerized data banks that can be accessed rapidly from remote locations. This adds to the "big brother is watching you" and privacy issues that are part of the social studies curriculum.

Progress in integrating computers as everyday tools into the overall curriculum has been slow. While some attribute this to a lack of sufficient hardware and appropriate software, the problem is deeper than that. We can see that by examining calculators. A good quality solar battery-powered calculator now retails at under $10, and often for as little as $6. Such a calculator can stand quite a bit of rough handling and will last for years. Indeed, one might compare it with a textbook in these regards. It would be quite easy for schools to provide all students with excellent access to calculators. But this has been slow to occur. Changes to the mathematics curriculum to reflect calculator capabilities are practically nonexistent, even though they have been recommended by the mathematics educator professional societies and other leaders. Often use of a calculator is considered to be cheating. It might be all right to use a calculator at home, but it is not appropriate to use it on tests in school.

The calculator problem will likely be repeated with computers. The current curriculum content is well entrenched, supported through the textbook writing and adoption process; teacher, parent, school board and administrator knowledge; curriculum materials; and standardized tests. Often the initial argument against CII is that there is not adequate and sufficient hardware and software. Certainly that was the initial argument against calculators. But eventually hardware and software will not be the major issue. In some schools that is now the case. As the calculator example illustrates, that does not mean the computer will be integrated into the curriculum. Thus, it seems evident that one responsibility of a computer coordinator is to be a leader in computer-integrated instruction.

Some computer applications are rather general purpose, such as word processing, computerized information retrieval and computer graphics. A student who has mastered the use of word processing and/or a graphics package will find uses in a number of disciplines. Information retrieval, storage and organization is central to every discipline. The construction and use of data bases can be a powerful aid to studying almost any discipline. But how should instruction in such computer applications be fitted into the overall curriculum, and who should provide the instruction?

This needs to be a school district level of decision; implementation affects many teachers. For example, suppose that students learn to use a graphics package in the seventh grade. Then all teachers at the seventh grade level and higher should expect their students to make use of a graphics package when it is appropriate to the material being studied. When relevant to what is being taught, each such teacher should encourage use of computer graphics and provide additional examples of appropriate usage. This could occur in a social studies class, an art class, an industrial arts class, a science class or a mathematics class.

Or consider the growing importance of using computers to store and retrieve information. We currently expect all students to gain basic library skills. Eventually we will expect all students to learn to make computer searches of data bases. But it does little good to teach such skills to a seventh grader if no computer access for such purposes is available to the student in later grades.

The current classical example of a poor approach to CII is provided by many schools' approach to word processing. Many schools are introducing students to word processing in the elementary school grades. This can be done using as little as one or two single-user microcomputers in a classroom. But that amount of computer access is a severe impediment to the student who wants to write. If the students have not received formal training in keyboarding, their average typing speed may be about three words per minute. That is, most students can print or write in cursive perhaps five times as fast as they can type.

Contrast this situation with the needs of a serious writer. Most serious users of word processing type faster than they can write. A typing speed of 30 words per minute or more and the ability to compose at the keyboard are common. Eventually such writers become highly dependent upon having access to a word processor whenever they want to write. If schools want word processing to be an integral part of the student writing process, they will need to provide substantial formal instruction and opportunity for practice.

The general-purpose computer applications constitute the core of CII. They also constitute one major aspect of computer literacy for teachers. If CII is to become an effective reality, all teachers will need to learn to use computers and to work with students who use computers as tools on a daily basis. All teachers will need to learn to help extend student abilities to make effective use of these tools. This massive inservice education problem falls on the shoulders of computer coordinators.

Other computer application packages, such as spreadsheet or accounting packages, are not as widely applicable in a precollege curriculum. But spreadsheet provides a good example. A computer coordinator needs to make sure that this type of computer application is appropriately integrated into the curriculum. Does it belong in an office practices or other business course? Is it an appropriate topic in a mathematics course? Is a spreadsheet useful in a social studies or science course? The answer may be yes in all cases. This type of question could be addressed by a committee of teachers and curriculum coordinators; it is appropriate that a computer coordinator head such a committee.

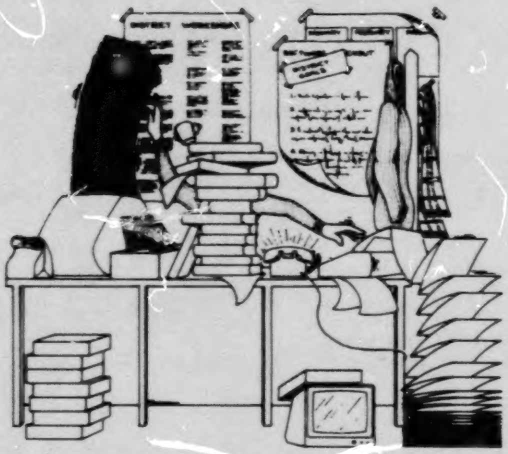
In recent years the field of computer applications has made very rapid progress. Software is becoming more user friendly; windowed software is used via keyboard, mouse, touch screen, graphics pad and voice input. Integrated packages allow the easy intercommunication of graphics, word processing, spreadsheet, data base and telecommunications. These are powerful tools, and their integration into the curriculum is not easy.

Still another example is provided by computerized instrumentation for use in science labs. In recent years a substantial amount of appropriate hardware-interface equipment and software have been developed that could contribute to a high school science course. But few high school science teachers have knowledge of the availability or potential of this hardware and software. The secondary school or district computer coordinator must help science teachers to make progress in integrating computers into the science lab.

Other examples are available for both art and music. We now have some quite nice computer aids to creating art and composing music. The point is that the typical subject matter teacher has little computer knowledge and therefore needs help in finding out what computer materials are available and appropriate. This problem will decrease as more and more teachers integrate computer use into their courses. Once again we see the need for a computer coordinator to be a resource person and for broadly-based teacher training in the computer field.

As a final example, consider the issue of keyboarding. There is considerably agreement that if students are to use computers for such tasks as composition or entering data into data bases, formal training in keyboarding is essential. At what grade level should it occur? Who should teach it? How should this instruction fit in with typing and other business skills courses taught in the secondary school? How will instruction in keyboarding affect student progress in spelling and reading? These are typical problems that a district computer coordinator faces.

Our analysis of CII suggests that a computer coordinator must have very broad academic and curriculum skills. The computer coordinator must work with teachers and curriculum coordinators in all disciplines and at all levels to plan and implement CII. But the computer coordinator needs to be aware that the overall goal is to improve the quality of education. The implementation of CII does not automatically improve the quality of a student's education. Computer coordinators must work with evaluators and teachers to determine the effects of CII, and to ensure that appropriate use is being made of computers.



Chapter 8
Summary of Computer Coordinator Responsibilities

The three-pronged analysis given in the three previous chapters suggests a computer coordinator may have a wide range of responsibilities. These might be divided into two major categories: planning and implementation. At the highest level planning must be done on the nature and extent of learning/teaching about, using and integrating computers that will be part of the overall curriculum design. This says that a computer coordinator needs to be a curriculum leader—a curriculum generalist who can facilitate change at all levels and in all aspects of the curriculum. Needless to say, good interpersonal relations skills (good "people" skills) are essential to this task. Many current computer coordinators suggest that the greatest amount of their time is spent working with people, and thus that interpersonal skills are the most important needed qualification.

The planning must also take into consideration resources available for implementation. Money is certainly one possible resource, but existing hardware, software and computer-oriented supportive materials are also resources. And people are an essential resource. What computer-related knowledge, skills and attitudes do the various teachers and administrators have? Are administrators, curriculum coordinators, and department heads able and willing to devote time and energy to implementing instructional uses of computers? Do the school board members and taxpayers support increased instructional use of computers?

A school system has many discretionary resources that might help facilitate instructional computing. Who decides whether the school and district libraries should subscribe to computer-related periodicals or purchase computer-oriented books? Is inservice money available to offer computer-oriented courses? Is travel money available so that some educators can visit schools making good use of computers or so educators can attend computer conferences? Are teachers encouraged to attend computer conferences? Are sabbatical leaves given to educators who want to study the computer field? Who gets the curriculum planning and development money that gets spent each year? It is evident that a school system has many resources that might be brought to bear in the instructional computing area. This type of analysis suggests that a computer coordinator needs to know the ins and outs of educational politics and the overall budgeting and spending process.

The money resource is (will likely always be) very important. A computer coordinator will have a budget and may have to make a case for a still larger budget. A computer coordinator makes recommendations involving large amounts of money from general district funds. A computer coordinator may be responsible for drawing up specifications so that vendors can bid to provide hardware and software. This analysis suggests that budgetary and financial skills are useful.

Planning is done in light of a school or school district's overall goals and plans. This suggests that a computer coordinator must work with high-level administrators, planners and possibly with parent groups and the school board. Once again, this suggests the need for good skills in dealing with people. It also suggests the need for good written and oral communication skills and for a broad general knowledge of curriculum at all levels.

Some school districts analyze the overall duties of a computer coordinator primarily based upon the above (planning) ideas. This could lead to a conclusion that a computer coordinator is primarily an administrator and should hold an administrator's credential. Certainly it leads to a conclusion that a school district computer coordinator should be paid on the administrative pay scale. It is clear that administrative skills and good ability to work with administrators are essential. But many of the implementation aspects of a computer coordinator's work require other types of knowledge and skill. Most people who hold administrator's credentials lack the computer-oriented technical knowledge and experience needed to be a good computer coordinator.

Implementation, of course, involves still more planning. But it also involves acquisition and maintenance of hardware, software and supportive materials; teacher, administrator and parent education; curriculum development and assistance to teachers; technical support to people at all levels; and facilitating change in the overall educational system.

One need only analyze any one of the five areas listed in the previous paragraph to see the difficulties in being a computer coordinator or the difficulties in specifying needed qualifications of a computer coordinator. Consider, for example, the acquisition and maintenance of hardware, software and supportive materials. As suggested in "The Two-Percent Solution" (see the Appendix of this book), a school district can easily spend well over one percent of its overall budget in this area. In a district with 10,000 students that could amount to more than $300,000 per year.

Dealing with such funds is no small task. The process of going out for bids on computer hardware or software is quite complex. Contracting for the actual purchase of hardware and software involves careful negotiation with vendors. Such negotiations may take months; meanwhile, new equipment comes on the market and prices may change drastically. The legal aspects can be very difficult. A person carrying out these activities may need some school law and fiscal training.

Or, consider teacher, administrator and parent education in a district of 10,000 students. The computer coordinator may be responsible for the computer-oriented education of over 500 educators and perhaps 10,000 parents. This responsibility could well be equivalent to a full-time college-level teaching position. The typical computer coordinator has been a classroom teacher. However, the teaching of teachers, school administrators and parents is quite a bit different than teaching children. It is a new set of skills to be mastered. Moreover, there are a wide range of topics that might need to be covered. Music teachers need to learn possible applications of computers to ear training and to music composition. Language arts teachers need to learn about process-oriented writing in a word processing environment. Science teachers need to learn about laboratory instrumentation.

The issue of technical support to teachers and administrators is particularly difficult. A teacher attempts to use a new piece of software, and something goes wrong. Likely the teacher doesn't know if the difficulty is hardware, software or a combination of both. Who helps the teacher? A teacher for the hearing impaired has heard about software and voice-input hardware to help students learn to speak. Who helps this teacher explore the technical aspects of this computer application?

A district already owns some computer equipment. It is thinking of expanding the capability of this equipment, perhaps by acquiring projection television monitors, ink-jet printers, a hard disk and networking. Who provides technical advice?

A common situation is that a school district already owns quite a large number of one or two models of microcomputers. It needs more equipment. Should it buy more of the same, or should it be open to acquiring something different? A decision must take into consideration the current investment in both software and in teacher knowledge. It must consider how well current equipment is standing up under its usage, and it should consider long-term vendor support. Will the local vendor or the manufacturer still be in business a couple of years from now? Will a growing amount of educational software be available for the machines one is considering? Such questions make computer acquisition a hard issue.

At the school building level or in a small school district, the computer coordinator is expected to be a major source of technical knowledge. In a larger school district, there will likely be a number of teachers and other people who have considerable technical expertise. In any case, the computer coordinator is expected either to know answers to technical questions or to provide an appropriate referral to a person or other source. Thus, the computer coordinator needs to develop contacts with students, teachers, vendors and others who have the needed technical expertise. The computer coordinator must know of books, magazines and journals that contain answers to the types of questions teachers and school administrators ask. The computer coordinator must learn to make effective use of such resources.

A computer coordinator is a change agent, dealing with a rapidly changing field and helping to facilitate change. The totality of computer science and computer education knowledge is expanding very rapidly. This suggests that a computer coordinator should be an intelligent, hard-working individual who is open to new ideas and comfortable with change. A computer coordinator must have a technical background that makes it possible to keep up with changes in educational computing.

It also suggests the value in having specific training in educational change processes. For example, professors Beverly Showers and Bruce Joyce at the University of Oregon have done extensive research on educational change and effective inservice projects. Inservice education can be vastly more effective in producing educational change if it incorporates what is now well known about how to design and conduct inservice education. For example, most inservice is done using the self-contained, one-shot approach. Research suggests that this is quite ineffective. Much more change occurs in the classroom behavior of teachers if inservice is backed up by follow-up activities such as additional sessions and classroom visits. Inservice instruction should include practicing the behaviors to be implemented in the classroom. Teachers can be taught to be coaches for each other. A support system of teachers all involved in a particular educational change is a considerable aid to realizing that educational change. Educational change is much more apt to occur if a school principal is actively involved in learning about the proposed changes and helping to implement the changes.

The feedback mechanism for planning and implementation is evaluation. Schools and school districts need to evaluate their instructional uses of computers to see if they are effective. Evaluation is an essential, and usually overlooked, computer coordinator responsiblity.

The actual job description of a computer coordinator will, of course, depend upon details of the particular position. In Chapter 3 we listed some possible responsibilities of a building-level computer coordinator. The following list is more appropriate to a district-level computer coordinator, but certainly overlaps the building-level computer coordinator list. Think of this as a shopping list. No district-level computer coordinator can be expected to do all of these things. But all of these things may be deemed desirable by a particular school district. If so, more than one person will need to be involved in carrying out these responsibilities.

- **Provide leadership in all aspects of developing, and periodically evaluating and updating, a district plan for instructional computer use.** Work with district and school administrators, curriculum coordinators, building-level computer coordinators and others, such as out-of-district consultants. The plan should cover learning/teaching about computers, learning/teaching using computers and learning/teaching integrating computers. It should be consistent with state, provincial and national computer education goals. It should mesh well with overall district educational goals. It is essential that the plan be flexible and provide for easy updating. The revision cycle needs to be quite short.

- **Provide leadership in implementing the district plan for instructional use of computers; the implementation should include provisions for evaluation and periodic updating.** Work with principals, department heads, building-level computer coordinators, teachers and others who will help implement the district plan. Develop a cadre of school-level computer coordinators and computer teachers who are committed to implementing the district plan. The district computer coordinator should meet regularly with these school-level leaders. Each school should have a computer committee charged with developing and implementing a plan for instructional computing in their school. These school plans will vary from school to school, but should all be consistent with district plans. Make sure the school plans provide for procedures to assess progress in achieving the goals set in the plan. Establish evaluation guidelines so that data from different schools can be compared and can be used as part of the evaluation of district progress.

- **Understand the district budget, budgeting process, and spending process; work within this system to secure adequate resources for instructional computing.** Provide budgetary leadership in the instructional computing field. Make effective use of one's own budget and staff. Help to ensure that building-level budgets and the district budget adequately support the district's instructional computer plan. Be especially aware of equity issues when doing budgeting and distributing resources.

- **Develop a district computer resource center to be used by building-level computer coordinators, computer teachers, computer-using teachers and others.** The resource center may contain hardware, software, courseware and instructional support materials such as books, magazines, journals, films and videotapes. When an especially nice piece of hardware or software comes out, obtain it for the resource center. Even a temporary loan, with an open house and publicity to the district personnel, can be quite helpful. A district computer resource center may be a lending library for both software and hardware that particular schools need only infrequently. It may be used as a meeting place for computer education committees and as a lab for computer inservices. Help to develop resource centers in every school. These resource centers may be an integral part of the facilities needed for inservice education. A school resource center should take into consideration the needs of teachers in the school.

- **Develop and maintain a list of resource people.** Some parts of this list may be suitable for distribution throughout the district. Other parts may be just for personal use. The list might include the entire district staff, with information about the computer background, interests, and involvement of each person. Identify at least one computer leader in each school and one computer-oriented leader in each academic discipline. Encourage each school to develop a list of parents who might volunteer their services as computer aides, technical assistants or fund raisers. Develop contacts with vendors who are willing to provide loans of hardware and software; some vendors provide free training to educators.

- **Develop, implement and periodically evaluate a district computer-oriented inservice plan.** One goal of this inservice plan should be to identify and/or help develop resource people in every discipline and at every grade level who can provide leadership in working to accomplish the district instructional computer plan. A second goal should be to help all teachers and school administrators become functionally computer literate and to learn their roles in accomplishing the district instructional computing plan. Ideally, every educator in the district should have a personal plan for becoming more computer literate. A district inservice plan needs to take into consideration workshops and courses available from other school districts and from nearby colleges and universities. Private businesses may provide appropriate training on a contract basis; sometimes they will provide free workshops, perhaps to encourage possible purchase of a new product.

- **Help the district to develop and implement plans for the acquisition and maintenance of hardware and software.** Acquisition will likely involve going out for bids for both hardware and software about once a year, although one may be able to piggyback on a state or province purchasing contract. It is highly desirable to have all schools take advantage of the prices obtained through these bid processes. Thus, the school district acquisition plan should be followed by the individual schools and the school district. However, the overall acquisition process must be flexible. Schools and individual teachers may have needs that cannot easily be met working through a district acquisition plan. For example, a special education teacher may need an input device controlled by eyebrow movements. A magnet arts school may need special graphics equipment or music synthesizers. Such special needs should be met in a timely fashion.

  Maintenance will include routine preventative maintenance as well as more general repair and replacement. It might prove desirable to have one teacher in every school trained to do a minimal level of maintenance. In secondary schools one might want to have some students trained to provide this service. A district may want to maintain a supply of spare parts and hire a person who can repair the types of equipment the district is acquiring.

  The district software policy should also address the issue of whether the district or individual schools will support, encourage or discourage software development. It should contain a clear statement against software piracy. District inservice programs should address the software piracy issue; the goal is to have the district policy understood and supported by all school personnel.

- **Maintain an accurate inventory of computer hardware and software that belongs to the district and to individual schools in the district.** Help set policy on the possible creation of a district-owned pool of hardware and/or software that resides in particular school buildings and that can be moved from school to school as needed. Help establish procedures for schools to borrow software from each other. Try to establish an "effective life" for hardware and software, so that hardware and software that is no longer appropriate to use can be removed from service.

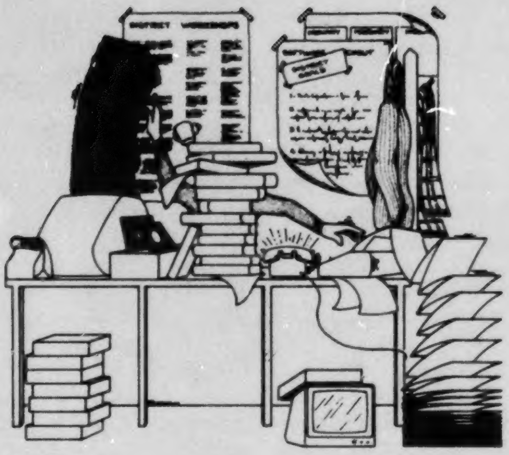
- **Help develop and implement a district procedure for the evaluation of software, hardware and courseware, and for the sharing of the results of such evaluation.** Tie in with other school districts and with national organizations that are doing software evaluation. Decide whether to make use of the EPIE and MicroSIFT software evaluation services. Acquire books and periodicals that evaluate software.

- **Disseminate computer-related information throughout the district via a newsletter, computer bulletin board, presentations at district and school staff meetings and so on.** Establish a liaison committee of key people in the community and meet periodically with this committee. Help to create and/or work with a local computer-using educators group. Work with a state or province group of computer-using educators. Be an active participant in local and regional non-computer education conferences, perhaps doing presentations on computer applications.

- **Work on community relations by speaking to parent and professional groups, publicizing the district computer plan and progress.** If possible, arrange for newspaper, radio and television publicity. Consider having the district or individual schools participate in computer-oriented science fairs and in computer programming contests. Encourage schools to have computer-oriented open houses for parents, with students demonstrating what they have learned about computers. A school computer club might want to raise money by using school computer equipment to instruct parents in how to use computers.

- **Encourage the development and implementation of a district hiring policy that takes into consideration the computer knowledge and experience of applicants and gives preference to computer literate applicants.** Communicate to teacher training institutions that your school district is only interested in hiring computer literate teachers.
- **Help the district to obtain outside funding by participating in grant planning and proposal writing.** Be involved in district research projects to evaluate instructional use of computers. Try to find funds to support individual teachers in developing pilot studies on various instructional applications of computers. The idea of pilot projects is important, even if extra funding is not available. Eventually your district must decide at what level to teach keyboarding and touch-typing. Who will teach it, and how long will it take? Eventually all students will learn to use a graphics package. Is this a mathematics department responsibility, and at what grade level? Pilot studies can help answer such questions.
- **Work to improve the overall quality of education received by students in the district.** Be sensitive to equity issues and work to resolve inequities. Be an educational change agent. (This is discussed more in Chapter 12.)
- **Do long-range planning on such topics as making use of computers at home, building-level and district broad-band networking, videodisc-based CAL, access to data banks, and greatly increased instructional use of computers.** Encourage the district to develop pilot projects to test the value of various major changes in computer usage. A large district could be experimenting with a school or certain courses in a school having greatly increased computer access. Certainly every large school district should now be experimenting with videodisc-based CAL.
- **Remain technically competent.** Continue to grow as a professional computer educator, as an educational leader and as a human being. Be professionally active (attend meetings, give talks, write articles) at a regional or higher level. Subscribe to computer-oriented educational publications and schedule regular time to read them. Be aware of the idea of the half-life of a technical education. The computer field is changing rapidly. A computer coordinator who doesn't spend substantial time acquiring new knowledge and skills will eventually be technically incompetent.

This list is overwhelming and should be used with some care. It can assist a school district or computer coordinator in writing a job description. But this requires careful thought, to match the responsibilities to particular needs of the district and/or to particular qualifications of the computer coordinator. The next chapter discusses possible qualifications of a computer coordinator.



Chapter 9

Qualifications for a Computer Coordinator

Chapter 3 contains a list of possible responsibilities for a building-level computer coordinator, and Chapter 8 contains a more extensive list of possible responsibilities for a district-level computer coordinator. These lists indicate activities a computer coordinator may be called upon to perform. From these lists one can determine the qualifications a computer coordinator might need. In this chapter I categorize and discuss these qualifications.

At first glance, it seems that the variety of knowledge and skills a computer coordinator might need is beyond that of an ordinary mortal. A frequent statement of teachers, perhaps only partially facetious, is, "If I had all of those qualifications, I'd leave education and get rich." And yet, many people satisfy the requirements and do remain in education. Being a computer coordinator is a challenging, but rewarding career. It is a career offering the opportunity to make a significant contribution to education and to make substantial personal growth.

I have divided general qualifications of a computer coordinator into four main categories. The categorization is somewhat arbitrary, and some categories overlap; still, this categorization approach is useful.

1. A broad general education and dedication to lifelong learning. Overall intelligence and perseverance; a strong work ethic; high ethical standards; self-confidence; good time-management skills; budgeting and other fiscal skills.
2. Knowledge of and support of our educational system; good skills in teaching school children as well as in teaching educators and other adults. Knowledge of change processes in education and knowledge of educational evaluation.
3. Interpersonal relations skills, especially in being a good listener; skills in written and oral communications; administrative skills.
4. Technical knowledge in the fields of computer science and computer education. Substantial experience in working with students and educators in the computer field. Knowledge of teaching and learning theory as they relate to the computer field.

The responsibilities placed on a computer coordinator vary widely from district to district and from school to school. Thus, it is not possible to specify an ideal mix of strengths from the four-part list given above. Each area is important.

The first general area of qualifications is based upon the need for a computer coordinator to work with a diverse group of educators and students. At one moment a computer coordinator may be responding to the needs of an art teacher; next may come a problem from a mathematics, social studies, science or industrial arts teacher. Later a school board member, a superintendent or a principal may raise specific issues; a budget officer may raise questions about budgeting for the purchase of hardware and software. The computer coordinator must be able to meet all such people at least somewhat on their own grounds.

Computer coordinators spend most of their time interacting with people. Each person coming to the computer coordinator has specific problems and is seeking help. Since the total number of people with problems is large, the demands placed upon a computer coordinator's time are also large. Time management skills are quite useful. It is common for computer coordinators to work 50-60 hours or more per week and still feel that there is not enough time to do what needs to be done.

One of the big demands upon a computer coordinator's time is keeping up with changes in the computer field. It is helpful to be a rapid and voratious reader. Overall intelligence and a broad educational background are quite helpful in keeping up.

A computer coordinator is an educator, working in a school setting. The coordinator has as a major goal working to improve education through appropriate uses of computers. The second general area of qualifications suggests that a computer coordinator should be an experienced teacher, preferably with teaching experience at a variety of grade levels. The computer coordinator should have experience in working with children and computers. The computer coordinator should feel comfortable in going into a classroom and presenting computer-related ideas to students at all levels. Moreover, most computer coordinators have substantial adult education responsibilities. Teaching teachers and teaching school administrators are quite demanding tasks. A person can be quite successful at teaching younger people and fail miserably in teaching adults (or, vice versa).

The third general qualification area includes all aspects of communication with others in one-on-one and small group settings. Computer coordinators spend most of their time working with people, and being a good listener may well be the single most important qualification to be a successful computer coordinator. Computer coordinators must be skilled at sensing the feelings and moods of individuals and groups. They must be skilled in working with people to accomplish specific tasks. Computer coordinators spend a great deal of time in meetings with school administrators and teachers. Often it is necessary to prepare written materials for use in these meetings as well as written reports of the meetings. A computer coordinator with poor writing skills is severely handicapped.

The fourth qualification area concerns specific technical qualifications in computer science and computer education. In essence, the first three types of qualifications are important to any person working as a curriculum coordinator or instructional leader. It is this fourth area that allows a person who meets qualifications 1-3 to function well in the computer field. Chapter 10 discusses this topic in more detail.

It is unlikely that a person seeking a computer coordinator position will be equally qualified in all four areas. More typically, a computer coordinator is reasonably well qualified in all areas but is particularly strong in one or two of the areas. It is not evident to me that any one of the four areas should dominate. One can find many examples of very successful computer coordinators with any one of the areas as their dominant strength.

In a number of workshops for computer leaders, I have asked participants to rank the four qualification areas in order of importance. Invariably the interpersonal skills area is ranked as most important while the technical skills area is ranked least important. My personal opinion is that these two areas should be tied for the most important.

The typical person who would like to be a computer coordinator is currently an experienced, successful and hard-working school teacher. This suggests that the person is likely to meet whatever minimal requirements might be set for the first and second areas. Of course, additional training and experience may be required. For example, many teachers lack administrative training and experience. Their knowledge of school budgeting processes and dealing with budgets may be weak. Their knowledge of school curriculum and change processes in education may be limited to the grade levels and subjects they teach.

The third area concerns interpersonal and communication skills. The majority of current computer coordinators rate this area as the most important from the total list. A person who has weak interpersonal and communication skills is not apt to succeed as a computer coordinator. In particular, a person who is a computer hacker, who most prefers to be with computers rather than with people, may well prove to be a very poor computer coordinator. Interpersonal skills can be improved by training and experience. A few self-help books are listed in the references section of this book.

A surprising number of people who seek computer coordinator positions have poor writing skills and are uncomfortable when communicating in writing. Writing skills can be improved by study and practice.

The final issue is how much technical knowledge in computer science and computer education is required. It is said that in the world of the blind, the one-eyed person is monarch. Few school teachers have a substantial knowledge of computer science. Many people who currently hold computer coordinator positions have only a modest level of computer-oriented technical knowledge. Probably less than one percent of such people have computer science knowledge equivalent to that a student obtains in a bachelor's degree in computer science at a good university or in a good master's degree program in computer science education. This may be contrasted with the academic preparation of subject matter coordinators and specialists in other disciplines. There an education-oriented master's degree is commonplace.

My conversations with a number of computer coordinators and with people who would like to be computer coordinators suggest that the issue of computer-oriented technical expertise is controversial. While they feel that technical expertise is important, a majority feel it should be ranked at the bottom of the four general qualification areas. However, quite a few feel that technical qualifications should rank near or at the top of the list.

The issue is confused by the possible breadth of responsibilities of a computer coordinator. In the learning/teaching *about* computers area, it is desirable that a district have considerably technical expertise. In a small district much of this expertise might be provided by a computer coordinator. In a large district it is more apt to be provided by the computer teachers.

Similarly, the learning/teaching *using* computers can require considerably technical expertise, both in the computer field and in the areas of teaching and learning theory. In a small district the computer coordinator may be the prime source of this expertise. In a large district help is available from curriculum coordinators, evaluation specialists and a variety of teachers.

My personal opinion is that a lack of technical knowledge is a major handicap, both to the computer coordinators and to the school districts in which they work. It is a handicap that a computer coordinator can partially overcome by added strengths in the other three areas. But good long-term progress of instructional use of computers at the precollege level requires that its leaders be technically competent. The next chapter discusses this topic in more detail.

In any event, a person seeking to become a computer coordinator can examine the lists of possible job responsibilities given in Chapters 3 and 8. The person can do a self-assessment against the types of qualifications discussed in this chapter. The results should provide guidance for negotiating specific job responsibilities. It should also help one determine a plan for self-improvement.

Chapter 10
Technical Qualifications

A computer coordinator must work with teachers, administrators, and two groups of technically-oriented people—vendors and computer scientists. The coordinator must keep up with progress in computer-related instructional materials, hardware, software, applications, and the discipline of computer and information science as it relates to precollege education. That is, a computer coordinator must be a professional computer educator.

Certainly the meaning of "keeping up" is dependent upon the nature of one's computer coordinator position. It may differ significantly between an elementary school and a secondary school computer coordinator. An elementary school computer coordinator is likely supported by secondary-school and district-level computer coordinators. Major hardware decisions, both purchasing and maintenance, may be handled at a district level. Major software decisions may be made by committee at a district level, perhaps supported via centralized purchasing. The amount of computer science that is integrated into the elementary school curriculum may be modest compared to what might be integrated into the secondary school curriculum. The elementary school computer coordinator may be mainly a computer-assisted learning specialist or perhaps a computer-integrated instruction specialist. This analysis suggests that an elementary school computer coordinator may not need to know as much computer science as a computer coordinator at a secondary school or district level.

Still, there is the articulation problem and the continued push to introduce computer-related ideas into lower and lower grade levels. That is occurring while the average computer literacy level of teachers remains modest. The elementary school computer coordinator is making computer-related curriculum decisions that affect the entire content of the elementary school curriculum. These decisions, in turn, affect curriculum at the secondary school level.

Another aspect to consider when analyzing needed technical skills is the nature of technical support available to the computer coordinator. In a small school district there may be no teachers or other staff who have a good knowledge of computer science. Then the computer coordinator must be the technical expert as well as handle a variety of other duties. In a larger district there may well be a number of teachers with substantial computer science knowledge. A computer coordinator may well have staff with substantial technical knowledge. Strength in interpersonal skills may well be most important to a computer coordinator of such a district.

There is still another major factor that must be included in this analysis. Over the short run computer coordinators are having to make major decisions about all aspects of instructional use of computers. National and state goals have not been set or carefully defined. Standardized hardware, software, curriculum guides and support materials do not exist. Computer usage has not yet been integrated into the widely adopted textbook series. There are relatively few computer-literate teachers, and most people just entering the teaching profession are computer illiterate. In other words, the whole field of instructional use of computers is still in its infancy; this places additional burdens upon computer coordinators. Additional discussion on this topic is given in Chapter 12, "Making the Hard Decisions."

The problem of how to train computer coordinators and computer teachers has existed for many years. The Illinois Institute of Technology and the University of Oregon were pioneers in analyzing and responding to this need. These schools started the first master's degree programs in computer education about 15 years ago. In recent years there has been a proliferation of certificate programs and master's degree programs in computer education; such programs are becoming commonplace. A certificate program may have about one-third to one-half the technical content of a master's degree program in computer education. Both master's degree and certificate programs are designed to prepare computer coordinators and computer teachers. The typical program is apt to include students with both career goals in mind.

Details and specific requirements of master's degree programs vary from school to school. However, a master's degree usually requires a minimum of 30 semester hours (45 quarter hours) of graduate credits. Often such programs require slightly more than this minimum number of hours. A master's degree program in computer education may have various prerequisites for admission and then six major components. The list given below is typical for a reasonably strong program.

0. **Entrance Requirements.** Often the applicant must be a certified teacher and meet certain undergraduate grade-point average requirements. The applicant must be able to program very well in one language (the equivalent of six semester hours of coursework) or reasonably well in two languages (equivalent to a three-hour course in each language). For many applicants this programming knowledge is self-taught or obtained through inservice courses that are quite different from introductory computer science courses in a university. Most master's degree programs accept BASIC and Logo as prerequisite languages, but some now require Pascal. For such programs if an applicant does not have a good functional knowledge of Pascal, the applicant may be required to take a course that does not carry graduate credit (thus, does not count toward the required 30 semester hours). In any event, introductory programming courses in BASIC do not carry graduate credit toward a master's degree in the stronger programs.

   Most schools allow the computer-oriented entrance requirements to be satisfied by self-taught knowledge. For example, if an applicant submits evidence of being the teacher of a year-long high school programming course in BASIC, this might be considered to being equivalent to having had six semester hours of coursework in BASIC. A person who has developed and taught substantial programming courses for teachers and other adults is usually considered to have met the six-hour prerequisite.

   In the past, prerequisite knowledge has been set quite low because few teachers had the opportunity to gain a solid initial exposure to computers. Now, of course, many teachers have had formal computer coursework while in college or even while in high school. The availability of the Advanced Placement (Pascal) exam adds substance to the prerequisite issue. Might one require a solid high school knowledge (that is, a freshman college knowledge) of computers as prerequisite to courses carrying graduate credit toward a master's degree in computer education? Currently there is still substantial resistance to that idea, but gradually it will gain support.

   Over the long run prerequisites for admission to a master's degree program or a certification program will gradually increase. These programs will eventually be fed by a stream of students who first encountered computers while in elementary school and who have had many years of computer experience. Already we are beginning to get students into these programs who used computers throughout their undergraduate college work.

1. **Introduction to Computer and Information Science.** *(6-9 hours)* These two or three beginning courses are generally similar to or the same as those required of freshman undergraduate computer and information science majors. They cover an introduction to the field, generally using Pascal as the language. The courses stress problem solving, top-down analysis, control structures, data structures, machine architecture and general theory of computer science. This is roughly the material covered in the Advanced Placement (Pascal) exam. Note that many high schools are devoting two solid years of coursework to covering the material of the AP exam.

   Quite a few secondary school computer science teachers feel that they have taught themselves computer science at this introductory level. However, most are mistaken. The rigor and competition in a solid, university-level introduction to computer science is substantial.

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2. **Introduction to Computer Education.** *(3 hours)* This is a survey course, providing a general overview of computer education. The course likely requires the reading of one or more books, the examination of a substantial amount of software, and becoming familiar with some computer-oriented journals and magazines. Many school districts offer an equivalent course on an inservice basis. The course generally contains a number of computer applications that a teacher can immediately use in the classroom. Many applicants for admission to a master's degree program in computer education have already designed and taught such a course.

3. **Topics in Computer Education.** *(6-9 hours)* A variety of courses might be available. Examples include Computers in Special Education, Computers and Composition, Computers and Teaching Reading, Teaching Computer Literacy, Teaching Computer Science, Computers in Mathematics Education, Computers in the Social Sciences, Logo and Problem Solving, Computer-Assisted Learning, and Introduction to Videodiscs in Education. Many of these courses have as prerequisite both the Entrance Requirements (0) and the Introduction to Computer Education (2).

   Here we begin to see one difference between weak and strong programs. A strong program tends to have courses that build upon previous courses. Advanced courses in computer education should assume substantial knowledge of computer science and computer education, and they should build upon this knowledge. In weaker degree programs nearly every course is a beginning course, simultaneously enrolling both rank beginners and much more advanced students.

4. **Computer Applications.** *(3-9 hours)* Two types of courses are offered. Through a Computer and Information Science Department, one might take introductory or survey courses in areas such as Computer Graphics, Modeling and Simulation, Information Retrieval, Artificial Intelligence, and Networking and Telecommunications. These courses usually have the Introduction to Computer and Information Science (1) as a prerequisite.

   Through a College of Education one might take education-oriented courses on Word Processing, Data Bases, Spreadsheets, Graphics, Telecommunications, and Gradebook Programs. These courses may have as prerequisite the Introduction to Computer Education (2). The courses offered through a Computer and Information Science Department tend to be somewhat theoretical, and they usually have solid computer science content. The application courses offered through a College of Education generally focus upon specific pieces of software, perhaps being both machine and software dependent. They tend to focus upon topics that are immediately useful to classroom teachers.

   It is in the Computer Applications area that we often see a major conflict between Computer and Information Science Departments and Colleges of Education. A Computer and Information Science Department tends to feel that the best preparation to be an educator is solid, somewhat theoretical, subject matter content. A College of Education tends to place greater emphasis upon applications, the particular content being used in the schools, and pedagogy. A good program of study achieves an appropriate balance between these two points of view. It allows the students to help make decisions as to which orientation best fits their professional needs.

5. **Specialization Area.** *(6-9 hours)* This allows a student to build a modest concentration in a specific area such as computer and information science, early childhood education, special education, computers in mathematics, computers in science, computers in social science, computers in art, or computers in music. A concentration in teaching and learning theory might be appropriate for a person who is deeply interested in computer-assisted learning. A concentration in program evaluation or in educational change processes would be appropriate for a person preparing to be a district-level computer coordinator.

   A person preparing to be a secondary school computer science teacher will take a specialization in computer and information science. The coursework will follow the pattern of courses required of undergraduate computer and information science majors. The total degree program for such students may include more than the minimum required number of hours, since undergraduate computer and information science courses frequently do not carry graduate credit toward the degree. Similarly, specialization in an area such as computers in art assumes prerequisite and/or concurrent coursework in art and art education. Students lacking such undergraduate preparation will need to take undergraduate courses to expand their background knowledge.

   If a person is preparing to be a computer coordinator, the specialization area might include coursework in school administration, budgeting, small group dynamics, and change processes in education. A person preparing to be a building-level computer coordinator may want to include a course on managing a computer installation.

6. **Master's Project.** *(3-6 hours)* The master's project is not a course, but generally requires an effort equivalent to three to six semester hours of coursework. It draws upon knowledge, attitudes and skills acquired throughout the program. It may be school curriculum-oriented, such as designing and teaching a computer unit for elementary school students. It may involve designing and implementing some CAL materials. It may examine computer-integrated instruction in a specific subject area. Or, it may involve writing a paper based upon one's own research and the research literature.

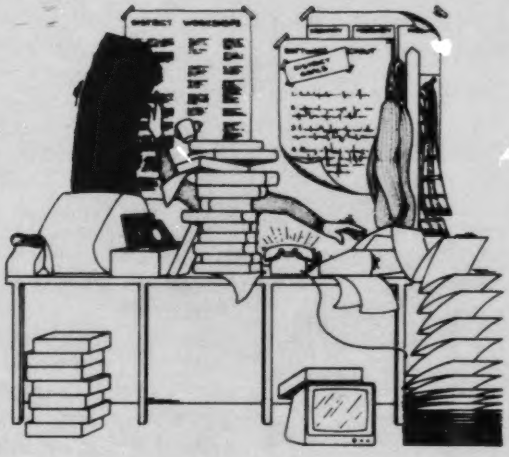
   In some programs an internship is used in lieu of a master's project. Such experience is valuable, but this value must be matched against other uses of the time. The typical candidate for admission to the master's degree program in computer education already has had computer education experience. The candidate will obtain substantially more experience on the job after graduation.

It should be evident that the combined fields of computer science and computer education is very large. A certificate program may cover about one-third to one-half of the requirements of a strong master's degree program. A master's degree program can include adequate formal education to be a computer teacher, a computer specialist in a specific discipline, a building-level computer coordinator or a district-level computer coordinator.

Eventually, larger school districts may want their computer coordinators to have still more formal education, such as a doctorate in computer education. Currently there is a severe shortage of people with such credentials. People earning a doctorate in computer education are generally taking positions in higher education or in the private sector.

During 1983-84 the Association for Computing Machinery's Elementary and Secondary Schools Subcommittee addressed the issue of preparation of secondary school computer science teachers. Out of that work has come a 1984 recommendation for a specific set of courses as well as a list of electives. These recommendations call for a minimum of 18 semester hours of "pure" computer science coursework. A person who selects the computer science teacher options listed in 1-6 above and makes other appropriate choices can satisfy the ACM recommendations. For example, in the Computer Applications (4) area the perspective secondary school computer science teacher will want to select courses offered by a Computer and Information Science Department. The perspective secondary computer science teacher should take nine hours of computer and information science courses under the Specialization Area (5) option.

The program specified by areas 1-6 has quite a bit of flexibility and requires a substantial staff. Very few teacher training institutions are currently offering such a wide range of options. The offering of such a range of courses and options requires good cooperation between a College of Education and a Computer and Information Science Department. This type of cooperation does not exist at many schools. A person who is planning to enter a master's degree program in computer education should investigate in some detail the nature of the course offerings and requirements of the specific programs under consideration.



Chapter 11
The Computer Coordinator Position

Previous chapters have analyzed possible responsibilities of a computer coordinator and the nature of master's degree programs in computer education. The current reality of most computer coordinator positions is quite a bit removed from the somewhat theoretical and idealistic analysis given in those chapters. This chapter discusses the nature of many computer coordinator positions and how these positions are filled. The interviews section following Chapter 12 contains information from interviews with leading computer coordinators. None of the people interviewed had formal training equivalent to a master's degree in computer science education. The interviews section provides solid information on the realities of being a computer coordinator.

At the current time there are very few precollege educators who have the computer knowledge and experience equivalent to a master's degree or even a certificate program in computer education. A large number of recently begun certificate and master's degree programs are just now beginning to produce graduates. There has been a surge of enrollment in such programs, and this surge will begin to produce a significant number of graduates during the 1985-86 academic year and summer.

Thus, a certificate-level or master's degree-level of training and experience is seldom currently considered as necessary for a person to be a computer teacher or computer coordinator. Rather, most such people are self-taught and trained on the job; their formal coursework in computing may be minimal. This can be seen by examining the credentials of computer teachers and computer coordinators in elementary and secondary schools.

Computers are no longer a rarity, even in elementary schools. Many elementary schools have addressed issues such as where to place computers, where to store software, and how to control or schedule access to the machines. There are several common solutions. One is to consider computers as instructional media, and therefore to place them under the control of a library media specialist. Computers are placed in a library or perhaps a room adjoining the library. Software is stored in the library, cataloged and checked out by the library media specialist. Software selection and acquisition is done mainly by the library media specialist, with the help of interested teachers. In such a situation the library media specialist may be the de facto building-level computer coordinator. Formal computer-oriented training to hold this position may consist of one or two days of workshops.

A common alternative arrangement is that one or two teachers exhibit particular interest in computers. They manage to obtain some computers for use in their classrooms. As the number of machines grow and as other teachers become interested, a computer laboratory is created in an unused classroom. A collection of software resides in that classroom, in the teachers' classrooms, or in the library media center. A teacher's aide or parent volunteer supervises the computer room. The responsibilities of building-level computer coordination are shared among several teachers, aides and the library media specialist. One specific teacher may be assigned duties of coordinating with computer educators from other buildings and with the district computer coordinator.

A third alternative is that an elementary school has a computer teacher. This person might have non-computer duties for half days, be a computer teacher for several elementary schools, or even be a full-time computer teacher for a single school. The computer teacher also serves as the building-level computer coordinator. If the school emphasizes computer-assisted learning, the person may be a CAL specialist.

In all three scenarios the elementary school often does not openly advertise the position of computer coordinator and hire a person specifically to fill that position. In the first two cases, there is a de facto "promotion" of a library media specialist or teacher to be computer coordinator. This person's preparation to be a computer coordinator likely consists of interest in computers, a workshop or a course on computers, and volunteering for the position. The computer coordinator has very little formal coursework in computer science or computer education.

The hiring of a computer teacher is often done more formally. The candidate pool may include teachers from other schools within the district, teachers from other districts, and perhaps people completing a certificate program or master's program in computer education. The successful candidate will likely be distinctly better qualified to be a computer teacher and computer coordinator than those who arrive at such positions by de facto promotions within the school building. Likely, the successful candidate will know BASIC and Logo, have developed and taught computer courses for teachers, and have considerable experience in using computers with kids.

At the junior high and high school levels, there is substantially more computer equipment and computer usage. Most secondary schools have implemented a number of computer courses. Initially, these courses may have been developed and taught by mathematics, science or business teachers. Typically, these teachers' initial computer preparation consisted of self-taught knowledge, perhaps backed up by a college course or two in computer programming. A surprising number of math teachers had a FORTRAN course sometime while they were in college or a BASIC course in more recent years.

Gradually, such a self-designated computer teacher gains more knowledge and experience. This may come both through teaching computer courses in the secondary school and through beginning to function as a building-level or district-level computer coordinator. The teacher is involved in planning and implementing courses for teachers and school administrators. The teacher is involved in acquisition of hardware and software. The teacher is involved in working with other teachers to develop and implement building-level plans for computer education.

A teacher performing all of these duties may feel inadequately prepared in the technical aspects of computer science and computer education. The teacher spends a lot of time playing with a computer, perhaps becoming a computer hacker. The teacher learns to use several application packages and becomes familiar with quite a bit of software. The teacher regularly reads several computer magazines. Continued interest in professional and personal growth may lead to taking courses during evenings, weekends and summers. It may lead to obtaining a certificate or master's degree in computer education.

As secondary schools develop their instructional computer plans, they often see the need for additional computer-oriented staff. They begin to take this into consideration when filling vacancies in mathematics, business or other disciplines. Eventually the amount of computer activity may justify hiring a full-time computer teacher. Typically, the applicant pool includes current computer teachers from within the building and district, as well as people from outside the district. However, there appears to be a strong tendency to hire from within the district.

It is then that the issue of being a building-level computer coordinator is likely to be formally addressed. A secondary school computer teacher may well have a reduced teaching load in order to spend time on computer coordinator activities. It is reasonable to combine the jobs of computer teacher and building-level computer coordinator if a reduced teaching load and an appropriate contract are part of the package. The computer coordinator may have an extended contract (working more days per year) as compared to a full-time classroom teacher. The computer coordinator may receive a percentage salary increment for having some administrative-type responsibilities.

Of course, it is possible both at the elementary school and at the secondary school levels that a person would be specifically hired to be a computer coordinator. A school with a major emphasis on computer-assisted learning might hire a computer coordinator mainly to coordinate computer-assisted learning activities. A school requiring all of its students to become computer literate might hire a computer teacher to design and implement a computer literacy plan. As schools gain more and more equipment, they will find that they have need for a computer facilities manager. Many high schools already have two or three computer labs plus a variety of additional equipment scattered throughout the building. Their collection of software is growing rapidly. Such schools could well make use of a full-time computer facilities manager/computer coordinator.

Some schools have found an alternative to hiring a teacher to manage their computer labs. Instead, they are hiring aides or other people who are not required to have a teaching credential. They argue that many, if not all, of the computer lab manager duties are not teaching duties. Sometimes the intent appears to be to hire a person on a lower pay scale. But quite often the best qualified applicants are certified teachers. Moreover, the duties of a computer lab manager in a school tend to blur into those of a classroom teacher.

At a school district level, the duties of a computer coordinator may initially be distributed among a collection of computer-oriented teachers and a computer-oriented curriculum specialist (for example, the district mathematics specialist). Eventually, one of two things tends to occur. One of the people helping to perform the district computer coordinator duties may prove particularly competent and interested, and take on more and more of these duties. This eventually leads to the district establishing the position of computer coordinator and "promoting from within," giving the position to the person who is already performing its duties. Alternatively, the need for a district-level computer coordinator becomes evident. The district writes a job description and advertises the position. The pool of applicants may be quite large. The successful candidate may have formal qualifications that include substantial computer education experience as well as a certificate or master's degree in computer education.

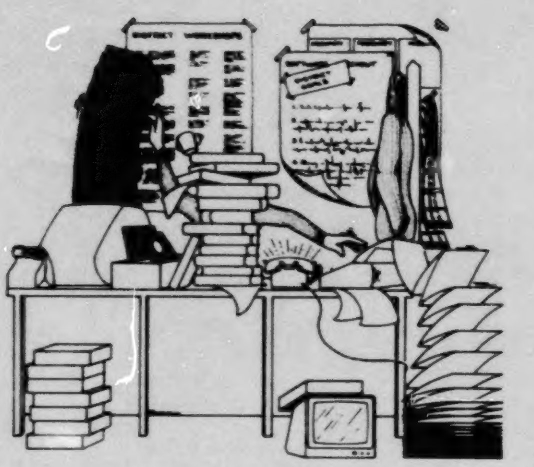
Earlier in this chapter I briefly mentioned the possibility of a building-level computer coordinator's contract being different from that of a classroom teacher. It should be evident that the duties and responsibilities of a computer coordinator exceed those of a classroom teacher. A school building computer coordinator likely will have responsibilities both as a classroom teacher and as a computer coordinator. The computer coordinator part of these responsibilities will likely involve working longer hours, participating in administrative-level activities, teacher education, curriculum planning, running a computer lab, and other related activities.

In many school districts the school building computer coordinator may be on a standard teacher's contract in terms of determining pay rate. But the number of days on this contract may be extended, or a percentage increment may be given for the different duties and responsibilities. In any event, the salary of a school building computer coordinator should exceed that of a teacher with equal years of teaching experience and education.

A district computer coordinator generally has duties and responsibilities equivalent to a relatively highly-placed school administrator. Whether or not the computer coordinator is required to have an administrative credential, an administrative-level contract and pay rate are appropriate. In any event, a district computer coordinator generally has a much more difficult and responsible position than a curriculum coordinator or subject area specialist, and therefore should be paid accordingly.

It is important to realize that computer use will continue to expand rapidly in our educational system. The duties and responsibilities of a computer coordinator are high and are apt to remain so during the next decade. Interestingly, however, there are those who argue that eventually there will be a decreasing need for computer coordinators. They argue that the computer coordinator duties will become routine and will be taken over by regular teachers and other personnel who are not computer educators. It will be interesting to see how the nature of computer coordinator positions changes as more equipment comes into the schools and as computer education becomes institutionalized.

The next chapter addresses some of the hard problems currently faced by computer coordinators. The value to a district or school in having a well-qualified computer coordinator will become more and more evident in the years to come.



Chapter 12

Asking the Most Important Question

Author's Note: This chapter provides me with strong personal evidence on the power of word processing. It began life during fall of 1983 as a perspective editorial for The Computing Teacher. *However, it didn't get used for that purpose. Later it was greatly expanded and modified into a keynote address for a 1984 spring computer conference in Alaska. Later some of its ideas formed the basis for a keynote address at a summer 1984 computer conference in Oregon. Now it has been revised and expanded to become a book chapter. This chapter contains ideas important to computer education leaders—especially to computer coordinators.*

The field of computers-in-education is beginning to mature. In a number of states and provinces, there are now enough microcomputers and enough computer literate teachers so that we can move beyond the initial exploratory stages of instructional computer usage. But most people have trouble seeing where we might be headed. They fail to ask the right questions, and they fail to set the most significant goals. The overall goal is to improve the quality of our educational system. The question to ask about each potential computer application is how it contributes to the goal. One of the main groups of people that should be asking this question is computer coordinators. It is their job to provide leadership as computer usage continues to grow and to have a significant impact on our educational system.

Over the past ten years, I have traveled extensively, giving keynote addresses and workshops at innumerable conferences. I have served on a variety of regional and national committees exploring issues of computer literacy and goals for computer education and teacher education. I have talked extensively with hundreds of leaders in computer education.

This intense involvement has given me the opportunity to monitor the progress of instructional use of computers. From my perspective, the progress has been relatively slow, but steady. The goals that most school districts are now setting and planning to implement were articulated ten years ago or more. The necessary types and depth of teecher training seemed clear even then. (A list of the goals is given in Chapter 1.)

However, three major changes have occurred over the past decade. Microcomputers became available, decreased in price, and increased in quality, making it feasible for schools to have appropriate computer equipment for computers to begin to have a significant instructional impact. Educational software or software suitable for education has proliferated; it is now rapidly increasing in quality. And equally important, a great many educators and lay people have become convinced of the educational values of computers, and therefore are lending support to setting and implementing instructional computing goals.

It has been fun to watch the changes during the past decade and to sense their acceleration toward ever higher levels. People in the computer field are used to change—indeed, they seem to thrive on such change. Major changes in hardware and software are occurring and the passage of even one year allows us to clearly identify the trends. Hardware continues to become both more capable and less expensive. The 16K system with a tape drive has given way to 48K or 64K systems with a disk drive. Some school systems are now specifying 128K as minimal requirements for the new systems they purchase. Printers are more common, as are color monitors. A trend toward graphics pad, touch screen or mouse as input devices is now evident.

A year ago it was still common to hear, "Ninety-five percent of the educational software is poor or worse." Now the figure quoted is often eighty percent, and the eighty percent is of a larger base. Certainly there is a clear trend of more and better software. This trend is especially evident in applications software and in integrated packages of this software. Integrated packages are now being tailored to the needs of education, and that trend will continue.

It is relatively easy to predict the short term (five year) future of the relatively inexpensive microcomputer hardware systems most apt to be available to schools. One need only look at microcomputer hardware components that are now in mass production or just about to enter mass production. The 16-bit CPU chip is in mass production and several companies are producing 32-bit CPU chips. The 64K-bit memory chip is in mass production, and several companies are producing the 256K-bit memory chip in quantity. (An October 1984 magazine article indicated that one company had recently reduced the price of 64K-bit memory chips to $1.85.) Indeed, several companies have been successful in producing 512K-bit or 1024K-bit memory chips on an experimental basis.

The inexpensive microcomputers five years from now will be based upon hardware currently in mass production. Thus, it will have a more powerful CPU and larger primary storage than most equipment currently in schools. More expensive systems will draw upon hardware that is currently in limited production or just now coming out of research labs. And we can dream about what lies still further down the road. A recently formed consortium of companies in the United States is talking about producing a four-megabit memory chip before the end of this decade! Imagine owning a hand-held microcomputer with a 32-bit CPU and a couple of megabytes of primary memory. But ten years from now that could be commonplace.

Certain aspects of the future of educational software can also be predicted with some confidence. The trend of improved quality software will continue. This is only common sense. The educational software market is both highly competitive and divided among a very large number of competitors. Each competitor studies the products already on the market, trying to determine what is good. New products are designed to compete against the best currently available. Poorer quality products are redone or eventually lose market share.

Another aspect of educational software is in the implementation of educationally-oriented versions of business packages. The *Bank Street Writer* provides the classical example, making a good quality word processor available to young students. It is fun to see that a new version of *Bank Street Writer* has recently appeared on the market, and that it is far superior to the original version. We can expect to see student-oriented versions of spelling and grammar checkers, electronic spreadsheets, graphics packages, data base systems and so on. These will be integrated into user-friendly and easy-to-learn packages.

Another major trend is toward larger, more complete computer-assisted learning packages. For example, several companies are working on and/or beginning to market major packages of material designed to help students learn to read and write. Such materials are to be used by students over a sequence of years and are a major supplement to current modes of instruction. The future will bring us major computer-assisted learning packages that cover all of the academic disciplines. Reading, writing and arithmetic are the obvious first choices for companies making the large financial commitments that are necessary.

A final trend is the production of software that ties in closely with existing textbook series. It is evident that textbook series will be with us for many years to come. More and more of them will be accompanied by software designed to supplement and enhance the texts. Quite a bit of this software will be developed and distributed by the publishers of the textbook series. However, some of the software will be produced and marketed by smaller, independent developers, and may be useful across a wide range of textbook series.

In light of these predictions and the growing amount of computer facility available to schools, we can ask some hard questions. For me, the hardest is, "How will computers improve the overall quality of education students receive?" A less biased variation on this is, "Will computers make a significant difference in the quality of our educational system?" I have spent considerable time thinking about this question and want to share some of my thoughts.

It is now evident that our school systems will be able to help all students gain an appreciable level of computer literacy, no matter how this term is defined. Students will encounter computers beginning in the primary grades and will grow up using computers as an aid to learning.

Computer programming is one important component of computer literacy. There is a growing trend toward having most students receive some introductory formal instruction in the rudiments of programming, perhaps using Logo in the elementary school or BASIC in the middle school/junior high school. For the most part, instruction in programming will be a self-contained, add-on part of the curriculum, not affecting what the student does during the remainder of the day or in subsequent non-computer courses. Without constant use and additional instruction, most students quickly lose their initial computer programming skills.

When **The Question** is matched against this potential progress, I feel the question remains unanswered. Achieving such a modest aspect of computer literacy—exposing all students to introductory computer programming—seems to me to be a worthy goal, but its overall impact upon the quality of a student's education is minimal.

It is frequently suggested that the computer as a tool, as in word processing or mathematical equation solving, will have a significant impact. Certainly professional writers and professional engineers appreciate such tools. But so far we have little solid research evidence that such tools can have a significant impact upon our precollege educational system. Indeed, even in higher education institutions with ample computer equipment, we have trouble seeing that such computer applications have had an appreciable impact. The potential seems large, but the potential has not yet been achieved.

Progress in computer-assisted learning is quite promising. Research on good quality CAL materials often suggests that students learn as well, have as good an attitude and learn faster. Many studies have reported CAL-based learning occurs 15% to 25% or more faster than conventional classroom-based learning. These studies tend to report long-term retention rates and student attitudes equivalent to those produced by conventional instruction.

If our schools continue to pour large quantities of money into hardware and software, then in a few years we might expect to have ten times the current level of computer facility. This will be quite difficult to achieve since there are substantial competing demands for these funds. A gain by a factor of ten will bring us to a nationwide level of approximately one microcomputer per six to eight students. If all of this computer facility were used quite efficiently throughout the school day, an average student would use a machine for a half-hour per day or more. If CAL were to be the dominant use and if this resulted in a 20-percent gain in learning rate during a half-hour per day, the net effect would be an average gain of about six minutes of student learning per day.

One might compare this six-minute gain with the effect of hiring quite a few teacher aides, purchasing better textbooks, assigning a little more homework, revising certain parts of the curriculum, paying good teachers more, extending the length of the school day or school year, and so on. For example, we might provide every elementary school student with a calculator and drop about half of the multi-digit long division from the curriculum. The time saved would approximate the effect of a number of years of CAL in the above half-hour-per-day model of computer usage.

The purpose of the argument is to raise questions about the wisdom of pushing hard for increased use of CAL. Of course, this type of argument is rather unfair. Consider an alternative. Suppose that we had good CAL-based courses in high school level mathematics and the sciences. If we concentrated computer equipment in schools that lack appropriate courses in these areas, then the typical student in these schools could use CAL for several hours per day throughout high school. This would surely have a significant positive effect upon those students.

The point is that while CAL has tremendous potential, the cost of achieving that potential is high and the timeline is long. The current and next-five-years impact of CAL upon our total educational system will be modest.

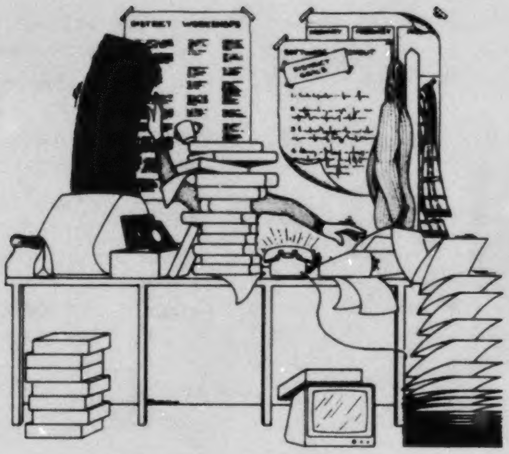
One can continue with these types of analysis, but perhaps the message is clear. We can deeply impact a modest number of students, and we can superficially impact all students. Over the next five years the deep impacts will most likely be in teaching quite a bit of computer programming and computer science to college-bound students, and using CAL for remediation for select students requiring such help. The overall impact upon our educational system will be quite limited.

I feel that the key issue is what comes next. During the next five years, we could invest heavily in curriculum and materials development and in teacher education. This could be oriented toward integration of computers into the entire curriculum. Computer-integrated instruction entails a re-examination of the content of every discipline, searching for appropriate roles of computers in every discipline. It entails dropping substantial amounts of material from some parts of the curriculum and reorganizing other parts.

But this adding and dropping of materials cannot be a seat-of-the-pants operation. It must be based upon a careful analysis of educational goals, and it must be backed by careful evaluation of the changes being implemented. It is here that federal funding of some major project would be very beneficial. We need to have some school that has one computer per student, computer-knowledgeable faculty, and curriculum that makes appropriate use of the computer. We need to research the new ideas before moving toward wide-scale implementation.

The goal is the eventual full integration of computers into all of the curriculum, as an aid to problem solving, as a source of problems, as an aid to knowing, and as an aid to learning. The calculator and multi-digit arithmetic calculations pale to insignificance when measured against this long-term goal. But if the long-term goal is achieved, it will be clear that computers have had a significant effect upon our educational system.

It is essential that computer coordinators and other educational leaders look carefully at the issue of computers in schools. Our overall goal is to improve the quality of education. There are many ways to do this, and many of these ways do not involve use of computers. We must examine each major computer-related expenditure in light of our overall educational goal. We must repeatedly ask the question, "Is this proposed expenditure of funds the best way to improve our educational system?"



Interviews: Introduction

Over the past dozen years I have known a number of computer coordinators. I have spent literally hundreds of hours talking to computer coordinators and other computer leaders about their work. This book reflects the general knowledge I have acquired about the computer coordinator position. While working on the book, I increased the amount of interaction I had with computer coordinators. In addition, I arranged to interview a number of leading computer coordinators so they could report on the nature of their positions.

This section of the book contains a number of interviews with computer coordinators. The purpose is to give a general flavor of the types of people who are computer coordinators, the work conditions they face, and what they accomplish. The names of the people being interviewed have been changed, and no atempt has been made to provide exact quotations as their responses to questions. Some attempt has been made to hide the identity of the school or district where the computer coordinator works. The first interview is a composite, representing several people.

Each interview report begins with a discussion of the job situation and the person filling the position. Then a sequence of relatively open-ended questions are given along with their responses. The actual questions asked during the interviews were similar to those in the following list. Responses were reorganized and grouped to produce the actual interview reports.

Sample Questions

- Please give your title and describe your computer coordinator position. Include information about your administrative and fiscal responsibilities.
- What is your educational background and work experience, both as a teacher and in preparation to be a computer coordinator? How did you come to obtain the position of computer coordinator?
- What aspects of your computer-oriented training and experience have been most helpful to you?
- What are the areas in which you feel you need the most work in order to improve yourself as a computer coordinator?
- Describe what your school/district is doing in computer education. Include information about the amount of computer facility that is available and how it is being used. Also comment on computer-oriented inservice education and the general level of computer knowledge of teachers and administrators in your school or district.
- Does your district have a computer plan? Do the schools in your district have individual computer education plans?
- What role do you play in helping the school/district reach its computer education goals? How many hours per week do you work?

- How do you and others evaluate computer-oriented progress in your school or school district? Is there an evaluation plan for the district or for individual schools?
- How are you evaluated? To whom do you report (as a computer coordinator)? What do you do to maintain and increase your competence as a computer coordinator? In particular, how much time do you spend reading, trying out new software and hardware, and learning new things each week?
- What is the most exciting part of your computer coordinator job?
- What is the least fun part of your computer coordinator job?
- Do you have a computer coordinator contract, or any type of job security as a computer coordinator? Describe the nature of your contract.
- What are the most important or the most critical decisions you have to make as a computer coordinator?
- What do you consider to be the most important qualifications necessary to do your job well?
- What could the district computer coordinator or your immediate supervisor do to help you more? What could others do to help you? Do you have some sort of support group, such as a regional organization of computer coordinators that meets regularly?
- What is your pet peeve about being a computer coordinator?
- Do kids or teachers in your school copy disks? How do you deal with this?
- What progress do you expect your school or district to make in computer education during the next few years?
- What role do you expect to be playing in computer education five years from now?
- What else would you like to tell people who have computer coordinator positions or who are thinking about becoming computer coordinators?

Middle School Computer Coordinator Interview

Position Description

Alice is a building-level computer coordinator in a middle school of about 300 students and 16 teachers. She teaches mathematics two periods a day, computer literacy two periods a day, has one preparation period, and has one period of release time due to being the school's computer coordinator. The school day is six periods long and the usual teaching load is five periods. The school has eight single-user microcomputers in a classroom that is used four periods a day to teach computer literacy and computer programming classes. It has one microcomputer in the library. All students in the school are required to take a twelve-week computer literacy course while in the sixth grade.

Alice is in charge of the computer classroom and schedules its use when it is not being used to teach computer courses. She works with the library media specialist to organize the school's collection of software, and she makes sure appropriate software is available to the non-computer teachers who want to make use of the computers. She meets about once a week with the school's computer committee which consists of four teachers. She meets once a month with the school district's computer committee.

Alice has taught computer courses and been the computer coordinator at her school for two years. She has also organized and taught two different courses for teachers—one on Logo and one on word processing. Each had ten hours of class meetings, one evening per week for four weeks.

Qualifications

Alice has a bachelor's degree in mathematics and is currently working on a master's degree in mathematics education. She has been teaching for seven years in junior high schools and middle schools. Alice is divorced, with no children, so she can spend a great deal of time outside of school working with computers.

Alice first became interested in computers via a FORTRAN course taken while an undergraduate. Since then she has taught herself BASIC and Logo as well as word processing. Next summer she hopes to take a Pascal course as part of her master's degree work in math education.

Alice was instrumental in her school's getting computers three years ago. She did this by attending a number of district meetings and convincing the district computer coordinator that her school would be a good place to pilot test a computer literacy course that might eventually be required throughout the district. Two years ago she organized and taught the first computer courses her school offered. She has managed to get other teachers interested and to get a 12-week computer literacy course required in her school. This is still an experiment, but likely the whole district will implement such a requirement next year.

Interview

As computer coordinator, you get one release period per day. How much time per week do you spend on computer coordinator activities?

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In school I spend about two hours a day on computer coordinator activities. Actually, I spend more time than that, supervising the lab before and after school. But I can grade papers and work on lessons during part of that time. In addition, I attend meetings which average about an hour a day. I guess I spend about 15 hours a week.

Can you give me more details on how you spend your time?

Nobody tells me specifically how to spend my time. Some kids like to get to school early, in order to use the computer. Thus, I arrive a half-hour or so earlier than most teachers. Similarly, kids like to use the computers after school, so I supervise the computer lab for an hour and a half after school. Those are my biggest time blocks.

I had the principal organize a computer committee, and it meets about twice a month on Thursday afternoons. We now meet once a month with some parents—on the first Monday evening of the month. In these meetings we talk about software, courses, goals and getting more hardware. The president of our school's PTA is on the committee, and the PTA is going to raise some money for us this year. Our school's library-media specialist is on the committee. She orders software for us. When it comes in, she makes an archival copy, catalogs the software and puts it in a notebook. We have one microcomputer in the library, so that kids and teachers can try out various pieces of software.

The district computer committee meets on Friday afternoons, right after school, once a month. These meetings are fun because I get to learn what the other schools are doing, and I learn about new pieces of hardware and software. Often several of us go out for pizza afterwards, and then we go on to the house of someone who has a computer and some new software. I am thinking about buying a computer for myself, as soon as I can save a little money. Right now my car needs some work.

What is your school's computer budget situation? Do you have money to spend? And what are the bounds of your overall authority to act as a computer coordinator?

Most of our school's hardware comes through block grant funds at the district level. We have one machine purchased with PTA funds and one we got using money the principal found. I have a budget of $500 per year for software; I think maybe this money comes from the district. I also have to buy ribbons and paper using that budget, but sometimes we use a different supplies budget for that. Money is definitely a problem; we need books, materials and more software. If a machine breaks, the district fixes it. I just call the district computer coordinator's number, and eventually it gets fixed.

Some of the teachers suggest that they know where I can get copies of software—they are talking about pirated stuff. The kids are always wanting to bring in programs they got from their friends. I don't allow any of this to happen, but sometimes I think it might be okay. We sure do need more software.

The principal says I am in charge of the computer lab. I get to decide when it will be open and who can use it when classes are not scheduled. I am head of the school's computer committee; part of my job is to help decide what courses we should offer and how the computers should be used.

If people disagree with the way I am trying to run things, we usually take it to the principal. She seems to support me most of the time. She took a computer workshop two years ago and thinks computers are good things.

Do you get extra pay for being a computer coordinator?

No, I am on a regular teacher's contract. However, last summer all of us on the district computer committee got one week's pay to work on new courses. And the district paid my way to an out-of-state computer meeting last year. Also, I earned a little money teaching courses for teachers during evenings last year.

Do you have a pet peeve about your computer coordinator work?

It really bothers me that most teachers can't see how important computers are. They are willing to let me have computers and do all the work. But they don't try to learn about computers and use them in their teaching. And I don't like the way boys try to crowd the girls off the machines, and the girls just sit there and take it. Maybe this wouldn't happen so much if we had more machines and more teachers made use of them. I make sure that the girls in my classes get equal access to the machines.

What else would you like to tell people about your computer coordinator work?

Computers are what make my teaching job interesting. I teach computer classes two periods a day, and I make use of computers in the math classes I teach. I spend a lot of time talking to teachers about computers. I spend time in the evening reading computer magazines and thinking about ways to use computers in school. I am planning to buy a computer. And it really would be fun to have a robot. I guess they cost quite a bit, so that will probably be a while.

I guess what I am saying is that computers are fun—they have made my teaching job much more fun. I am thinking about switching out of the mathematics education program into a computer education program and getting a degree in that area. If it weren't for computers, I guess I would be thinking about getting out of education. Now I think that I'd like to be a district computer coordinator. I guess that would mean moving on to another district, but that would be all right.

School District Computer Coordinator Interview

Position Description

Bill is a district-level computer coordinator in a school district of about 40 school buildings, 17,000 students and 1,200 staff. This staff total includes administrators and many part-time teachers. The district has been involved with instructional use of computers since the late 1960s and in recent years has made a substantial commitment to increased instructional uses of computers. The district currently has about one microcomputer or time-shared terminal per 35 students. The high schools have the most equipment with middle schools next and elementary schools last. However, all schools are involved.

Bill's position is nominally half time as district computer coordinator and half time as inservice coordinator. These two positions are somewhat intertwined, and in both positions he reports directly to the assistant superintendent for curriculum. He has a full-time secretary. In addition, a half-time teacher and a full-time aide work under his supervision in the computer education area.

Bill arrived at his current position through first being hired as an elementary school curriculum coordinator and then gradually taking on more and more computer-related responsibilities. Eventually, this change in duties was recognized, resulting in a change in his title and formal job responsibilities. Although nominally one-half time in each of two positions, he actually spends about two-thirds to three-fourths of his time in the computer area. Moreover, since he works about 70 hours per week, the computer coordinator position is actually a full-time job.

Qualifications

Bill has many years of teaching experience in elementary school. He has a broad liberal arts education, including a master's degree in a social science area. He has very little formal coursework in the computer field; he is mainly self-taught. He has been involved with computers for about five years and has owned a microcomputer for four years.

Bill has very good "people" skills. He has broad knowledge of curriculum. He reads computer magazines and journals perhaps 10-15 hours per week and attends many computer workshops, conferences and presentations. He enjoys playing with computers and trying out computer ideas with kids. Bill is a family man and has made considerable (and successful) efforts to get his kids involved with computers.

Interview

You mentioned that you spend about 50 hours per week in the computer area. How is this time used?

The largest amount of my time is unscheduled. I receive about 30 phone calls a day. These come from teachers, parents, administrators, and from out-of-district people. Often I have to call back, since I am in a meeting or on the phone with someone else. Generally each phone call requires some action, such as meeting with a person, sending a person copies of material, referring the person to someone else, etc. The person who calls wants immediate action, so I am constantly being expected to respond.

I have formal, district-level meetings with groups of teachers or administrators about three times per week. These are usually a couple hours long. This is one way I disseminate information and receive input. And, of course, I have many meetings with individual educators and visitors.

During the day I have little time to myself. Thus, evenings and weekends are a relief. I generally read computer-related materials for two or three hours each evening, six days a week. My lack of a formal technical background in computer science probably is a handicap here, since I don't have a strong formal background to build upon. I am thinking about taking a sabbatical leave to study computer science education. But I am having so much fun on my job, I don't know if I would like to leave it for a year.

Your school district has about one station of computer facility per 35 students. That is more than twice as many as the national average. What is the computer-related budget situation in your district?

Our district spends about $200,000 per year for hardware, software, computer-related inservice education, my computer coordinator half-time salary, halt of my secretary, a computer aide, and a half-time teacher who provides technical assistance to me. I have direct control over about $60,000 per year which I can use for hardware, software and computer-related inservice education. The principals in each school building have

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some discretionary funds. That is one reason we have uneven amounts of computer hardware in various buildings. Another reason is that the PTAs have purchased some computers. I can make recommendations and try to get principals to make certain decisions, but they directly control quite a bit of money. For example, a principal and the teachers in a building can decide to free up a teacher part-time to serve as the building-level computer coordinator. They might do this by a slight increase in class sizes in the building. I can encourage this, but I cannot make it happen.

I have read your "Two-Percent Solution" editorial and used it with my supervisor and the school board. If we count everything, such as some building-level computer coordinators, we are at the one-half percent level. If budgets go well, we will more than double our computer expenditures for next year. Most of the increase will come under my direct supervision. Of course, if the budget situation goes badly, we will have to drastically cut our computer-related expenditures, and I will probably be back in an elementary school classroom.

I am not sure we are ready for the "Two-Percent Solution" yet. If we had had that much money a couple of years ago, we would have spent it very poorly. It is easy to spend a lot of money, but it is hard to spend it in a responsible manner.

We are doing some things that don't take much money. We have identified one computer person in each school building. We encourage teachers to take computer-related inservice workshops and courses. We encourage teachers to study the computer field while on sabbatical leave. We have encouraged teachers and administrators to buy computers for themselves, and many have done so. A special purchase was arranged, so they could buy computers at a good price. We loaned out some of our machines over the summer.

What are some other good things your district has done in the computer field?

We have done a lot of things. The district has developed goals which are broadly supported. We have adopted the ICCE software policy, and we strongly discourage piracy. The school board is interested in and supportive of our efforts. A number of our administrators have received inservice training and are supportive of instructional uses of computers. Our inservicing of teachers has been quite successful.

We have set up a computer resource center for the district. Last year it was staffed by a half-time aide, and this year by a full-time aide. We have a large and growing collection of software in this center. We spend about $9,000 a year for software for the center. We have a variety of microcomputers, so teachers can try out the software on the types of machines they have in their schools. We have multiple copies of some software for schools to borrow. We encourage schools to buy software they need to use on a regular basis, but to borrow infrequently used software.

We have good contacts with a nearby university. A number of their students get involved in computer-related projects in our schools. They have helped us evaluate some of our activities. The university offers courses that supplement and extend our inservice efforts.

Our district also makes substantial administrative use of computers which has helped get some administrators involved with computers.

We are also interested in videodiscs. We own a half dozen videodisc players, and we have one teacher who spends a lot of time in this area. We have exposed quite a few teachers to the potential of using videodiscs in instruction.

You mentioned that a bad budget for next year might result in a substantial cutback in computers and in your job. Would you care to elaborate on that?

I am not really sure about what sort of job security I have. I think I still have tenure as a teacher, and I have quite a bit of seniority. Right now I am in the administrator's collective bargaining unit, and I get paid on an administrative pay scale. I am on a 12-month's contract. I am trying to get my position changed so that I am a full-time computer coordinator. If budgets go well, that may happen. But if the budget situation is really bad, we will be laying off quite a few teachers. In that case I suspect that many of the curriculum coordinators and other specialists will be cut. I may be out of a job.

We do have quite a bit of computer facility in this district. In recent years we have put about half of our block grant funds into the computer field. But we have not established computers as a regular part of the district budget, with a major and continuing commitment. If the budget situation goes well, the school board might add several hundred thousand dollars a year to the instructional computing budget. The work we have done in the past is a solid foundation for that sort of increase, and I think we could use the money wisely. One of the things we would do would be to pay for some teacher release time, so that we would have a number of school building-level computer coordinators. They would be responsible for handling technical questions and problems arising in their buildings.

Do you have a pet peeve about your computer coordinator work?

I'm glad you asked that question. My peeve is that people don't understand my capabilities and limitations. They expect me to know everything and to be able to do everything. The typical situation is when someone phones me and describes a quite technical problem. It might involve a particular microcomputer, printer and piece of software. The assumption is that I am familiar with all of the details of every possible combination of microcomputer, printer and software. I can't possibly be responsible for knowing all these things, but I feel guilty because I don't know the answer.

What are your main concerns about the future?

I am worried about the budget. But even more, I am worried about how we are treating the building-level computer people. We have a number of teachers who are really dedicated educators and who are committed to working with computers. But we are expecting these people to do computer work and their full-time teaching jobs. We don't give them any release time or other benefits. I fear that they will burn out and lose interest in computers. They will retreat back into their classrooms, and we will lose a valuable resource.

What are your main words of advice to district computer coordinators?

I find myself torn between putting out fires and doing long-term planning and implementation. There are many fires to put out, and there is immediate satisfaction in putting out a fire. But I strongly recommend that you develop a support system that handles such details. Our support system includes the computer person we have identified in each school building, our plans to have building-level computer coordinators, and our current half-time technical expert. The best thing a district computer coordinator can do is long-term planning and implementation. This needs to be based upon a substantial amount of program evaluation. The goal is integration of computers into the whole curriculum, as an everyday tool for all students.

Interview with a District Supervisor of Instructional Computer Services

Position Description

Charles is supervisor of instructional computer services in a midwest school district of about 32,000 students. He describes his district as urban-suburban, largely middle class, with about 20 percent minority population. The district has been involved with computers for quite a few years. Its hardware approach has been a combination of time-shared systems and microcomputers. The time-shared systems are all DEC machines and the microcomputers are mainly Apples. Currently, the district has about one microcomputer or time-shared terminal per 35 students, which is better than twice the national average. The elementary schools have five to 16 microcomputers each, depending on school size. The middle schools each have about 25 microcomputers. The high schools have both microcomputers and terminals to the time-shared systems.

Charles has two full-time computer coordinators, an administrative assistant and a secretary working under him. In terms of the overall district administrative organization, Charles is at the fourth level. A superintendent, deputy superintendents and program directors are above him. However, he is on a 12-month contract and is paid on an administrative pay scale.

The overall approach to computing in the district is centralized. Planning and purchasing decisions are made at the district level. There are no computer coordinators in individual schools; indeed, there has not been an identification of "building leaders" in computing in the individual schools. The school district has an instructional computing plan, but individual schools do not have their own plans. Even efforts to have the magnet schools develop their own plans have not been particularly successful.

Qualifications

Charles' undergraduate work was in physical education and mathematics education. He became a secondary school mathematics teacher and continued his academic studies. He now has a master's degree in mathematics education, about 20 credit hours in the computer field, and miscellaneous other credits. He has considerable experience as a mathematics teacher, as a mathematics specialist at the district level, and in his current position.

Charles is a soft-spoken, dedicated educator. He is deeply committed to improving education by working through our public school systems. He is a leader in computer education in his state and has considerable involvement at a national level. He works about 50 hours per week and is currently taking a Pascal course to improve his skills in structured programming and Pascal.

Interview

You mentioned that your district has set goals for instructional use of computers. Please tell me more about these goals.

During the summer of 1983 we had a committee of teachers and coordinators. I got things started by generating a first draft of a plan. The committee provided feedback and expanded the plan. The plan is quite comprehensive and served as a basis for a substantial amount of the inservice work we did last year. It takes the approach of integrating computer usage throughout the curriculum, and it also addresses issues such as Logo. Last year we provided inservice sessions on each major part of the plan. If the total amount of inservice had been evenly distributed over all teachers in the district, it would have averaged about eight hours per teacher. Of course, we didn't reach all teachers, and some teachers have participated much more than others.

The approach we are taking to instructional computing is to integrate computer usage into the curriculum at all levels. We have put a number of microcomputers into each elementary and middle school, and we provide instruction in using these as tools. All of this is being done by regular classroom teachers. It is only at the high school level that we teach computer programming and computer science courses.

You previously asked if individual schools had discretionary money to purchase computer equipment or had developed their own instructional computing plans. The answer is no. Our district takes a central planning and purchasing approach. We distribute the computer equipment in an equitable manner. You also asked about computer coordinators or identified leaders at the individual school level. This turns out to be difficult, because it is a union-related issue. The union and the administration cannot agree on the identification of specific teachers nor on possible modification of their job descriptions or duties. Thus, our schools do not have computer coordinators. However, some principals have informally identified teachers in their schools to whom they can turn for help in answering computer-related questions.

Please tell me more about the teacher training going on in your district.

We are doing quite a bit. Last year we provided 14,000 teacher contact hours of instruction. A teacher goes up one notch on the pay scale for each 50 contact hours of inservice work. We probably reached 400 or 500 teachers last year. The state is also doing introductory training. I think they have a goal of reaching 18,000 teachers this year. The legislature appropriated money for this. And many teachers take courses on their own. When I got this job about five years ago, I was probably the most computer knowledgeable teacher in the district. Now there are quite a few teachers who have more technical knowledge. That is one reason why I am currently taking a Pascal course. I need to improve my technical skills so I can continue to provide effective leadership.

Your question raises an interesting point. We don't know which teachers have received computer training. This year we are creating a data bank of teachers and their computer backgrounds and experiences. It will allow us to see what inservice opportunities need to be provided. One of the things we stress in inservice is computer ethics, especially the software piracy issue. We help teachers to understand what is wrong about stealing software. I think we have done a good job here even though many teachers have not been in our workshops.

The data bank of teachers and their computer-oriented qualifications will be useful in evaluating the inservice program that you run. What else are you doing to evaluate progress of instructional computing in your district?

We measure the percentage of time that our hardware is being used. That is easy with the time-shared terminals, and we have also been able to determine utilization factors for our microcomputers. We have used survey instruments with teachers, mainly to determine whether they feel the district is providing appropriate and enough hardware and software, and whether the teacher-training opportunities fit their perceived needs. We count the number of computer courses being offered in the high schools and the number of students taking these courses. We also do informal evaluation, by talking to lots of teachers and administrators.

One of our administrators went to a workshop on how to evaluate the effectiveness of inservice programs. He came back and interviewed a number of teachers about their inservice experiences. He discovered that the inservice they were receiving was not effective in producing change in the classroom. I now have a copy of Graham Ferres' doctorate dissertation in which he investigates how to do effective computer inservice education. That has been very useful to me, and it (along with the interviews done by our administrator) has caused us to change our inservice approach.

What are the most exciting and fun parts of your job?

I like the excitement of the whole field. I visit schools, and I see the teachers are active, involved, excited. I see that the kids are having fun and learning. I get lots of positive strokes as I do my work. People appreciate the help I provide them, and I can see that I am doing a good job. We have come a long way in the past five years, and I feel good about the contributions I have made. I also enjoy long-range planning.I enjoy listening to and reading the projections of educational futurists, and then trying to bring some of their ideas into reality.

Could you speculate a little about what you will be doing five years from now?

I expect I will be doing the same things that I am doing now. I will continue to be active in computer organizations at the local and national level. I certainly don't expect my job will go away during that time. I suppose it could, if we have a terrible budget crunch and if the individual schools begin to have computer coordinators. Good success in the full integration of computers into the whole curriculum may decrease the need to have a person in my position. I guess if worse comes to worst, I can always return to the classroom. I have tenure as a teacher.

Are there things about this job that bother you? What is your pet peeve?

I don't like to do paperwork. I would rather be interacting with people—with teachers and students. But more and more I find that I am tied to my desk. Another thing that bothers me is the difficulty in interacting with the district leaders in social science, language arts, science, business, industrial arts, and so on. Each of these areas has a committee, generally consisting of secondary school department heads. I don't seem to be able to establish an effective dialog with these groups. Each group seems to contain its share of people that don't want to see any changes in education.

I don't feel that I have enough time to do all the work I am supposed to do and also keep up in the computer field. I feel that I am falling further and further behind in technical aspects of the computer field.

My pet peeve is the teacher who claims to be a professional, but teaches the same thing in the same way every year.

What do you feel are the most important qualifications for a computer coordinator? What else would you like to tell people who are thinking about becoming computer coordinators?

The most important qualification is being a good listener. I would rate interpersonal skills at the top of the list of necessary qualifications. Getting people to work with you, getting them to help accomplish the goals, that is most important. Next I guess is the ability to do long-range planning. That is especially difficult in the computer field, because things are changing so rapidly. Both teaching and administrative experience are essential. Seek out new opportunities, such as teaching teachers, serving on committees, and doing long-range planning. These will all help you to be a good computer coordinator.

My advice to computer coordinators is to not be afraid to ask questions. Don't be afraid to admit you don't know something. Talk to people, find out what they know, seek sources of information.

Rural Computer Coordinator Interview

Position Description

Doris is a microcomputer education specialist in a school district that has about 450 teachers and serves about 9,000 students. The district is largely rural, with many students traveling considerable distances by bus. There are eight grade schools, three junior high schools, and three high schools in the district. The district has about one microcomputer per 80 students, which is roughly the average for the United States.

The school district has recently undergone a 20-percent budget cut, due to the failure of a tax levy. The 20-percent cut completely wiped out all funds for new computer hardware, software and teacher training. It came upon an already tight budget, in which services have gradually been cut. This recent drastic cut removed all funds for busing students to and from school, as well as all funds for field trips, athletics and other co-curricular activities. Doris retained her position only because it was funded by a federal block grant; her position will be eliminated next year unless there is a significant improvement in the budget. Essentially all teacher aides, many secretaries, a number of temporary teachers and other support personnel were cut.

Doris is on a teacher's contract, both for pay rate and length of contract. She is in the teacher's bargaining unit and is excluded from the inner circle of school district administrators. But teachers view her as an administrator and tend to exclude her from the inner circle of teachers.

Qualifications

Doris did her undergraduate work in elementary education and was an elementary school teacher for many years. She then completed a master's degree in special education and a doctorate in school psychology. While in the doctorate program, she became interested in computers. She took a number of computer education courses, but minimal emphasis was placed upon computer programming and computer science. Much of her computer knowledge has been gained on the job, and she is currently auditing a Logo course to supplement her knowledge in this area.

Doris is a dedicated and very hard-working educator who particularly likes to work with children and with elementary school teachers. She works at least 60 hours per week and continually volunteers to take on additional tasks that will help students. At the time of the interview, she remarked that for the past week she had not been home before nine o'clock in the evening.

Interview

The recent budget cuts seem to be underlying much of our conversation. Would you care to say more about this?

During the past couple of years, our school district has made a lot of progress on teacher training, integrating computers into the curriculum, and working to use computers to improve the educational system. Now most of that has been put on hold. My initial budget of $125,000 was cut to zero. We were planning to spend about $10,000 on software, $15,000 on teacher training and $100,000 on hardware.

What really saddens me is that a group of community leaders have gotten together and are raising money to fund the athletic program. That program is continuing at a time when many students can't even get to school because there are no school buses! The athletic program and busing cost about the same. Some parents are spending as much as three hours a day driving their kids to and from school. It is a particular problem for parents who have kids in several different schools such as junior high and high school. These schools are widely dispersed in our county.

On the brighter side, our parent volunteers are working harder than ever. At the elementary school level, they are deeply involved with the educational process. I believe that is a part of the "third wave" movement.

No other computer coordinator I have interviewed has been as successful as you in making use of parent volunteers. Please describe some of the things they are doing in your district.

Our parent volunteer efforts are mainly successful at the elementary school level, and I have had a lot of help in making it work. The Parent/Teacher Association has been very active in fund raising to purchase computers. We have trained a number of parents to serve as computer aides. They have taken over the initial computer familiarization instruction given to all students. They are also teaching keyboarding and supervising students using computer-assisted instruction materials. Our large elementary schools have about 500 students. In some of these schools, the total volunteer effort is equivalent to two full-time people. Not all of the volunteer work is with computers, but that is a major area.

I hold regular training sessions for parents. I have close contacts with the PTA groups, and they are quite supportive of our computer education efforts. We also have computer faires for parents. Last year we had one large computer faire, for the whole district. I feel that it would be much better to hold computer faires in each school, and that is what I plan to do this year. Parents, especially with elementary school children, seem to identify with their community schools. There is a groundswell of support for education, and especially for computers in education. This is coming from the parents, not from the school administrators or school board members.

The volunteer work parents are doing helps to implement your district computer plan. What is that plan?

Our goal is to integrate computers as a tool throughout the curriculum. We want to use computers to help improve the overall curriculum. Computer-assisted instruction is used mainly in a remedial fashion. The overall plan starts in the first grade with initial familiarization, mainly treating the computer as another manipulative. In the upper elementary school grades, we do a lot with Logo and word processing. Our goal in word processing is to have students leave the sixth grade with appropriate keyboarding skills and a typing speed of about 25-30 words per minute.

Logo is a particularly difficult implementation challenge to our educational system, because our system tends to think in terms of scope and sequence. Many students have computers at home, or they go to computer camps. Typically, a teacher who has received computer inservice training has completed 10 hours of inservice. A traditional scope and sequence will not work in a situation where both students and teachers have varying levels of knowledge. Instead, we have developed a number of levels of Logo knowledge and related activities. We have task cards that students can follow. Our teacher materials assume an absolute minimum of computer knowledge. I view the elementary school Logo program mainly as a supplement to our art and math programs, and as an aid to developing the feelings of independence and power associated with being in control of a computer language.

At the junior high school level, we have a conflict between teaching BASIC and teaching Logo. Many teachers were in favor of BASIC, but they didn't know Logo. I arranged a Logo inservice, and there has been a gradual swing to Logo.

In our senior high schools, we have programming and advanced placement courses. We use microcomputers in our business courses, and we are starting to push for use in the writing classes. We don't have enough equipment for this, but we have done planning and some teacher training.

We are now working on long-term planning. It is not a scope and sequence plan. Rather, it is an integration into the curriculum, using computers as a tool to enhance the current curriculum and to help accomplish our district goals for education.

Please tell me more about your approach to teacher training.

I have given teacher training the highest priority. We have developed a cadre of 20 teachers. Last year they received small payments to teach 10-hour courses to other teachers. We reached nearly half of the teachers in the district. However, this amount of training is quite inadequate for what we are trying to accomplish. That is why our initial budget for this year contained nearly $15,000 for additional training. That would have paid the trainers, including funding some workshops run by people from outside the district.

I have a list of every teacher in the district and the computer inservice training s/he has received. I work with principals to get their teachers into appropriate inservice activities. Each school has a computer committee, and parents are actively involved at this level. We have a district computer advisory committee with a representative from every school, some administrators, some parents and a few other key district personnel. It meets once a month. The district committee has three subcommittees. These work on hardware, software and inservice training. Every member of the committee serves on a subcommittee.

Do you have a district computer resource center?

We don't have a central hardware resource center. Hardware is in short supply, so we want to put all we have out into the schools. We have a substantial collection of software. Schools can borrow a piece of software for up to six weeks. Incidentally, we have a very strict policy on copying software. We absolutely do not allow it. Our policy and the reasons for it are made clear in all teacher inservice and student instruction.

Each school has a software collection under control of the librarian. Individual schools spend some of their own money to add to their software collections.

What aspects of your previous training and experience have been most helpful to you as a computer coordinator? In what areas do you feel least prepared?

My background in learning theory has been most important. For me, computers are just an educational tool. I want to use them appropriately in the overall curriculum. To do this I need to know the overall curriculum and the process of learning/teaching. My graduate work and teaching experience has been very helpful. As a graduate student I learned about educational research and evaluation. This has been quite useful knowledge.

The job of being computer coordinator requires excellent interpersonal relations and communications skills. Many educators have these skills, but relatively few people with strong technical backgrounds have them. There aren't very many people like you who can bridge the gap, working well with both technical and non-technical people.

There are two areas where I feel I need more work: hardware and systems software. If a teacher has trouble booting a disk or accomplishing a more difficult task, I often don't know enough to tell if the problem is hardware or software. I am not very experienced with systems software, utilities, copying programs, and so on.

Budgeting has not been a problem. It seems to be common sense. If I have troubles, I know where to get help.

What is your district doing to evaluate instructional use of computers?

I rate evaluation as one of the most important things a computer coordinator can do or arrange for. We claim that computers are making or will make a significant contribution to education. But where is the evidence? My doctorate dissertation looked at special education students using computer-assisted instruction materials. When we use CAI, we should be able to measure whether this is an effective use of student time and the money spent for hardware and software.

We are evaluating our keyboarding and word processing program. How rapidly and accurately (i.e., number of sentences generated in a given amount of time, spelling errors, punctuation errors) can students write by hand prior to their keyboarding instruction? How well do they do using a word processor after a given amount of instruction and practice? Do their pencil and paper skills change as they learn to use a word processor?

What are the most exciting and least exciting parts of your job?

It is very exciting to see that computers are being used and that they are a focus for change in the overall educational system. There is a groundswell, led by parents and by many teachers. Parents are involved, and they want their children to get a good education. We have been able to focus this involvement into having parents serve as volunteer aides, serve on committees, and help raise money. I am also excited by the planning we do, and by progress toward accomplishing our goals. Our educational computing is not just hit and miss, but is carefully designed to improve the quality of each student's education.

The least fun part of my work is that the job is too big. I work very hard, but there is so much to be done. See this stack of journals sitting on my desk? That is the reading I haven't had time to do this fall. Also, I feel isolated. With our budget cuts I don't have funds to go to professional meetings or to bring in outside experts to run workshops.

Another part of the job that I find particularly frustrating is dealing with educators in the district, including administrators, who have very little computer knowledge. Last year I was evaluated by an assistant superintendent who was so busy that he didn't have time to learn about computers. He tried to be supportive, but some decisions were made from the top down to my office without research or a sound base of knowledge. At the individual school level, some principals take an active interest in the computer field, encouraging their teachers and getting involved themselves. In these schools we are making good progress. In other schools the principals are not involved, and this makes progress much more difficult to achieve. My pet peeve is the latter type of administrators.

What else would you like to tell people who are thinking about becoming computer coordinators?

Don't use computers unless you believe that computers can do the job better. Better might mean that students learn faster, retain their knowledge longer and have improved attitudes. Keep data—evaluate what you are doing. I believe very strongly in an infusion model; computers are an important new tool, and we want to use them to improve our educational system. We must collect data on whether computers are improving education and to help us make appropriate decisions on computer usage.

County Computer Coordinator Interview

Position Description

Edward is an instructional computing coordinator for a large, heavily populated county district which includes nearly 25 school districts, 140 schools and 70,000 students. His job is to promote progress in effective instructional use of computers throughout all of these school districts. Details of his job description vary from year to year, but always involve being up to date and knowledgeable in all aspects of instructional computing. He serves as a hardware, software, and planning consultant to the school districts in his county. He is working on a cadre leadership program, identifying one person in each school; coordination of staff development is one of his responsibilities. He works with and fosters local computer-using educator groups. Part of his job is to be active at the state and national level in professional computer education groups. Finally, he must also act as a public relations person for computer education activities in his county. Edward has secretarial help, but does not have a staff of computer people working under him.

Qualifications

Edward is a state and national leader in computer education. He is a well-known author, consultant, speaker and planner. He has worked as an educator for about 20 years, initially as a business teacher and then in computing.

Edward began using computers in the classroom in 1967, and he taught computer programming for many years. He is a very bright, hard-working and dedicated educator. He was one of the first people to serve as a computer coordinator in his state. In this interview he presents a number of important ideas acquired through his many years of involvement as a computer coordinator and instructional computing leader.

Interview

What do you feel are the most important aspects of your preparation that have helped you to become a successful computer coordinator?

I don't believe that there was anything specific in my college training that has been particularly important to being a computer coordinator. Most valuable to me has been the problem solving, group facilitation and human relations skills that I have obtained by training and experience outside of the formal university environment. My computer knowledge is self-taught.

In a non-training environment, what has been most important is that I am a voracious reader. I regularly keep up with about 25 periodicals, and I scan the table of contents of another 25 periodicals. If people are interested in this type of job, it is imperative that they keep up to date, and the only way to keep up to date is to read. If you are not a heavy reader, I suggest that you seek some other occupation. It is also helpful to attend conferences and to talk to knowledgeable people from throughout the country. But reading is the key.

What are some of the most important things you do?

I work to develop leaders, people who can help accomplish my job responsibilities. I do this by developing a cadre of leaders, of people who can be computer coordinators at the school and district level. I help these leaders develop their skills as teachers of teachers, as leaders in local and regional computer-using educator groups, as writers, and so on.

This task can be frustrating, since quite a bit of their learning and growing processes must be experiential. They keep trying to reinvent the wheel, making the same dumb mistakes we made years ago. I try not to stifle their initiative, but I do get frustrated. I encourage them to do more reading so they can be better aware of what others have already done and/or are doing.

Where is the computer education field headed?

I expect the number of computers available to students to grow rapidly. I believe that where we are headed is not a focus on computer literacy or computer programming. Rather, it is full integration of computers into the curriculum, making use of applications software. Many leaders now understand this, and we are doing a much better job of working toward this type of integration.

Another good thing that is going on is that the individual school districts are beginning to develop long-range plans for instructional use of computers. This has been surprisingly slow to happen. The funds coming from our state legislature are requiring this type of planning, and I feel such planning is an absolute must. I work with the district personnel, with parent groups, with computer-using educator groups and with others to develop these plans.

This suggests a major duty of computer coordinators, something I really enjoy doing. A computer coordinator must collect, consolidate, and share information on what other school districts have done. This is so that individual school districts and schools don't have to reinvent the wheel as they do their planning and implementation.

How do you or your districts evaluate progress in instructional use of computers?

I don't think anybody does; that's part of the problem. Even the state funding we are receiving does not require any careful evaluation. Anecdotal comments are all that are required. That is terrible.

What are some of the least fun parts of your job, and what is your pet peeve?

I don't like to field questions from people elsewhere in the country when they have their own local or regional computer coordinators. People will call me or visit me, and expect me to answer all their questions. I don't have enough time to do my own job, much less the job of people living on the other side of the country.

I don't like to deal with the petty politics that go on in a county education office and in the district offices. I don't like to deal with questions that really belong to our administrative computing people. I don't like to get involved with any aspects of administrative applications of computers, but I get stuck with quite a bit of this. I am intolerant of people who are supposed to be technically competent, and who aren't.

I am not too happy with my lack of job security as a computer coordinator. No matter how well I do my job, my boss or the superintendent could make my job disappear. Several of us who hold similar computer coordinator positions get together occasionally to discuss problems of mutual interest. We have discussed our job situations and find it to be scary. I find it quite helpful to get together with this group of computer coordinators, and I wish we could arrange to do it more regularly.

My pet peeve is that people expect me to give them an answer. They ask a specific question, such as "What piece of software should I buy?" I want to give them options and have them learn to make their own decisions.

What are the most critical decisions you have to make as a computer coordinator?

I make recommendations on hardware and software. I find it difficult to maintain an unbiased and open-minded position. People come to me and they want specific answers. "What piece of hardware should I buy?" I work hard to present them with alternatives and to help them to make reasonable decisions on their own. It is easier with software, to say that this particular piece of software is better than some other piece of software. In both areas I feel I am under a lot of pressure, but I try to pass the pressure on to the people who are actually doing the purchasing and will have to live with the decision.

What do you feel are the most important qualifications necessary to do your job?

I do not feel technical expertise is anywhere nearly as necessary as human skills—human relations skills and curriculum knowledge. I might have said something completely different in the past, but my feeling at this moment is that my knowledge of computer uses in the classroom is far more important than my ability to write good programs in several languages. It is also very important to know where/how to find information and to be good at brokering resources. Group facilitation skills are essential. Being able to listen to people, to find out what they are really saying, is very important.

Several times in this interview you have mentioned job-related stress. Could you expand on this?

As I have indicated, my job involves working with many different people and responding to their needs in the areas of hardware, software, planning and inservice education. And, my job involves keeping up. If I spent all of my time reading and talking to knowledgeable people from throughout the country, I would still not keep up as well as I would like. If I spent all of my time working with the people in my districts, I wouldn't be able to do all that needs to be done. Thus, I am continually under stress, trying to accomplish two tasks that are each more than I can do to my satisfaction. Sometimes I take out my frustrations on the people I work with. Sometimes I am impatient, not able to really listen to where they are coming from and to understand their point of view. I need to learn to calm myself down.

I really like my job; it is exciting, and I feel that I am making a major contribution to education and our society. But sometimes I think about taking early retirement, spending my time doing just what I want to do.

What else would you like to share with us?

I would tell people who are thinking of becoming a computer coordinator to make sure they understand a lot about curriculum. Make sure they understand what their objectives and motives are in taking a job like this. It should be to help everybody and to share their knowledge, not to keep the knowledge to themselves. This is really important. Some computer coordinators seem to think of their knowledge as power, and they try to use it to establish a power base. They act like they want to share, but in reality they are on a power binge. They do not seem to be dedicated to improving the educational system and helping kids. You have got to have the notion of sharing.

My own attitude about my job is that one of my responsibilities is trying to work my way out of my job. I try to develop district computer coordinators and school computer coordinators who can do what I am doing. If I do it well enough, I won't have a job. I am a sharer; I believe in sharing. I feel that is really important.

Interview with a Small School District Computer Coordinator

Position Description

Rebecca is a Coordinator of Program Evaluation and Educational Computing in a city school district of 5,000 students located in the southern part of the United States. The city has one high school, two junior high schools and six elementary schools. It is a modest-sized city, but it is the home of a major university. The presence of this university makes for a bimodal distribution of students, perhaps a classical "town and gown" situation. The city has between 20 and 25 percent minority population.

According to her job description, Rebecca's working duties are evenly distributed between program evaluation and computer coordinator activities. Each could well be a full-time position, and she tends to give the computer coordinator position more than half of her time.

The school district has about 120 microcomputers, which is about one machine per 40 students. Most of this equipment was obtained through use of Parent/Teachers Association funds and grants. Some of the grants are research projects being done in cooperation with the university.

Qualifications

Rebecca taught for about five years as a first grade teacher. She then took time off from teaching to begin raising a family. In 1976 her family bought a Sol microcomputer kit and put it together as a family project. This got her hooked on computers.

Since then she returned to school, first taking three computer science courses and then completing a master's degree and all of the coursework for a doctorate in educational psychology. She worked part-time as a paid aide, consultant, curriculum designer, and as an instructor of computer education courses—all while continuing her university education. Her university education qualified her for the position of Coordinator of Staff Development and Program Evaluation, which she obtained a little under two years ago. Her school system recognized a need for someone to provide direction in educational computing, but lacked funds to designate the position as a computer coordinator position. Her computer background and interest soon led to the school district making her computer coordinator in place of her staff development responsibilities.

Rebecca is a gifted writer and talented developer of curriculum materials. She has a deep understanding of education, especially its underlying goals and philosophy. She is very bright, and she works very hard.

Interview

You indicated that the PTA purchased about half of the computers available in your schools. Please tell me more about this, and tell me where the rest of your computers have come from.

The PTA organization in our city runs a thrift shop that is very profitable. The profits are divided among the schools, using a formula that takes into consideration size of school and the volunteer hours provided by parents from each school. The typical school gets more than $20,000 per year. These funds are allocated by the individual school PTAs for projects of their choice. They have put quite a bit into computer hardware, but it is not evenly distributed among the schools.

Some of our computer equipment has come from research projects we are doing in cooperation with the university. Right now we have a big project underway on use of computers with prealgebra students. I also have a grant that purchased 30 machines for Logo and word processing in the fifth and sixth grades. This grant was obtained in competition with schools from throughout the state.

At the high school level, we have made use of state vocational education funds to purchase equipment. We offer a variety of programming courses and word processing using this equipment.

Surprisingly, our school board has not provided any direct funds for computer hardware. In the past couple of years, the board has placed computer education on its top priority list. Unfortunately, each year the budget has been so tight that there was no money available to fund the purchase of hardware. But the board funds my position, so they are making some contribution to computer education.

What aspects of your university training have been most helpful to you in your computer coordinator work?

Knowing more than one programming language has been very helpful. My university computer science courses were of very high quality, and I learned Pascal, PL/1 and a little bit of COBOL. I have taught myself BASIC and Logo.

My university work in curriculum development, learning theory, and program evaluation helped me to get my job and has been very useful. The research courses I took have helped me to get the computer grant we are using to teach Logo and word processing in the fifth and sixth grades.

The 30 microcomputers we obtained from the state grant are placed in 15-machine labs in two elementary schools. They will be moved to two other schools for the middle part of the year, and to the remaining two elementary schools for the last part of the year. We are developing and carefully evaluating materials that can be used by the regular classroom teachers. This is exciting! The teachers receive only two full days of inservice training. We provide them with a computer lab helping teacher, a person who is quite knowledgeable about computers. This person helps to develop lesson plans and makes sure the machines are in good working order. But the teachers have to do the teaching—they are learning by doing, backed up by the computer lab helping teacher. I think the research training and the curriculum training I received at the university have been excellent in preparing me to handle this computer project. I will probably use it as my doctorate research project.

What are the areas in which you feel your training has been least adequate?

My weakest area is in group dynamics, facilitating the functioning of a group. I haven't had any formal training in this area, but I have learned quite a bit by experience.

I didn't take any math in college, except what was required to be an elementary school teacher. But in high school I was very good at math. I always advise students to take as much math as they can. It keeps doors open.

Please tell me about the planning your district and schools have done.

Planning has been given high priority, but not all of our plan has been implemented. For example, we intend to teach keyboarding at the K-1 levels. I have found some materials that I believe will be very good for this. We are not emphasizing computer-assisted instruction. Rather, our long-term goal is the integration of computers as a tool throughout the curriculum. I have mentioned the research we are doing with 30 microcomputers in the fifth and sixth grades. The emphasis is to train the regular classroom teachers to present the instruction and work with the students. Our district plan calls for Logo in grades 3-6, and word processing in the sixth grade. Currently students in these units of instruction are getting three to four hours of computer lab time per week. We have students working in pairs, but that isn't working too well for word processing. Only one person can type at a time, and it's not very interesting being a typing-observer.

At the junior high level, a number of the math teachers have gotten into computing and teaching computer math courses. These are under the control of the mathematics departments, but are computer courses. At the high school level, we offer programming in a variety of languages, and we offer word processing. The funds for this are vocational educational money, but the courses are straight computer courses.

Our state legislature recently allocated funds to address the need for computer literacy for students who are near graduation from high school. It is a stopgap measure, designed to catch students before they graduate. We are working hard to design a plan to use these funds for the purpose for which they are allocated. With student schedules already in place for the year, little software money, and little planning time, we are finding it to be a major challenge.

Our overall district plan calls for an equitable distribution of equipment among the schools. We currently don't have an equitable distribution because so much of the equipment was purchased using PTA funds. But at this stage of development, I question this emphasis on equity. We need to have enough equipment in one place to experiment with new ideas and to evaluate the results. Long-term progress is very dependent upon this research and careful evaluation.

Until now we have not had a formal district policy statement on copying software. I now think I understand the problem both from a teacher and a district point of view. I will work with my Computer Steering Committee to implement a strong policy against stealing software.

Our individual schools do not have computer education plans. However, each school has at least two people involved in computer education. One person, usually a media person, is responsible for software and has hardware maintenance and scheduling responsibilities. They work through my office if a machine needs repair or if their school needs to borrow hardware or software.

A second person from each school is designated as the Computer Steering Committee representative. I meet regularly with this committee. Last year we also had some lay people on this committee, but this year all we have is the one representative from each school.

I am probably the person most knowledgeable about educational computing issues in the district. At the elementary school level the grant is supporting a full-time computer lab helping teacher who is excellent. At the junior high school level some of the math teachers spend a good deal of their time teaching programming. They are mainly self-taught in programming. In high school it is the same thing, but it is vocational education teachers who have become the computer teachers.

One of the hardest parts of my job, but a part that I really enjoy, is doing long-range planning. It requires a deep understanding of education—a philosophy of education. It requires a maturity about educational computing that most people don't seem to have. I like to write in this area, and one article I published in *The Computing Teacher* has received considerable attention.

Do you have some sort of support group or other help?

Within the district I feel somewhat isolated. My contacts with the university are a great help. They have a really good computer science department and school of education. I have close contacts with several computer coordinators from other districts, where our jobs are similar. We get together regularly at conferences. Our state has a computer coordinator, a media person. This person works hard to provide opportunities for us to learn from each other. The state provides us with hardware help via a state purchasing contract.

How many hours per week do you work?

I work about 60 hours a week. I guess I do about 20 hours a week on my program evaluation duties and the rest in the computer field. I spend most evenings reading computer materials. I suppose I spend about 12 hours a week trying to keep up in the computer field. There is so much to read, and I am not a fast reader. Also, I really enjoy writing. I spend quite a bit of time writing articles and software reviews, and I am working on a book.

What are the most exciting and least exciting parts of your job? Do you have a pet peeve?

The most exciting is writing, giving talks, working with individual teachers and seeing teachers get excited. I really enjoy staff development work.

One thing that we did last year was very exciting. We had a family computer faire day that drew about 1,200 people. The emphasis was upon family computing, families sharing the computing experience. We had about 30 families bring in their machines and discuss home uses. We now offer family computing courses in the evening. An adult and a junior high school student are team teaching one such course now.

The least enjoyable part of my job is anything related to administrative computing or to administrative work. I don't like to keep track of our machines, do scheduling, worry about budgets, and so on. Until recently I was often called upon to help with administrative computing in the district. Now the district has hired a person to take care of that.

My pet peeve is people who are opposed to computers who have not taken the time to try to understand them.

What else would you like to tell prospective computer coordinators?

Keep the school rabbits away from the computers. If they escape from their cages, they will devour expensive power cords. I wish I'd been advised about this before I became computer coordinator!

Be prepared to be overwhelmed by the job, and be prepared to work very hard. Don't expect anyone else in your school system to really understand what your job involves. The program development aspects of instructional computing, developing a K-12 plan, are difficult. But being a computer coordinator is exciting. For me, it is by far the most interesting and rewarding work I have ever done!

Appendix A

The Two-Percent Solution

[Author's Note: This is a slightly expanded and modified version of an editorial by the same title published in the March 1984 issue of The Computing Teacher. *It discusses an approach to establishing the funding of instructional computing on a sound, long-term basis.]*

I am frequently asked how much money schools should be spending for instructional use of computers. My answer is that it depends upon the goals set by the school or district.

But that answer is less than satisfying to administrators in a school district just beginning to make a serious commitment to the instructional use of computers. Administrators need help in determining the level of expenses and nature of the commitment that may be necessary over the long run.

With these people I discuss "The Two-Percent Solution." The idea is simple enough. Let's see what could happen if a school district budgeted two percent of its total funds, year after year, for instructional computing. Some districts might obtain this level of funding by a reallocation of current funds. But since budgets have been so tight for so long, this is unlikely in most districts. As an alternative, one could imagine the taxpayers in a district passing a special perpetual tax that adds two percent to the district's budget. Or, one might imagine a one-percent tax and a reallocation of current funds to generate the other one percent. An analysis of how two percent of a district's current budget might be used for instructional computing helps one to understand how much money is actually needed.

Two percent is an arbitrary figure, but one can find many colleges and universities that have that level of expenditure for instructional computing purposes. Also, the use of a percentage figure relates expenditures to a district's overall funding level. This is important because funding levels vary widely. A recent issue of the *Wall Street Journal* discussed a school in Alaska that had a budget of $16,000 per student per year. The same article noted that the average for the United States is about $2,500 per student per year, with some states having an average per-pupil yearly expenditure of under $2,000.

Where will the two percent go? I suggest four major expenditure categories, with a reasonable level of funding for each. A fifth category, a contingency fund, is suggested to take care of unforeseen expenses. Keep in mind that these are merely suggestions; they can lead to insight into what a particular school district might do.

1. **Hardware:** *Approximately one-half of the total funds.*
2. **Software, print materials and other support materials:** *Approximately one-sixth of the total funds.*
3. **Inservice education:** *Approximately one-twelfth of the total funds.* This provides initial and continuing training for administrators, teachers, support personnel and aides.
4. **Computer coordinators:** *Approximately one-sixth of the total funds.* This might be used at both a district and a school building level.
5. **Contingency:** *Approximately one-twelfth of the total funds.* In the first year all of this might be used to supplement inservice education. In subsequent years it might be used in the other categories or for some new purpose, such as remodeling a room for a computer lab.

This sort of allocation assumes that office space, janitorial services, ongoing administrative and staff support, and other miscellaneous expenses will be part of the general school district budget and will not be specifically deducted from instructional computing funds.

To make this concrete, suppose we look at a school district with 5,000 students and a budget of $2,500 per student per year. The Two-Percent Solution allocates $50 per student per year for instructional computing.

Category	Per Pupil	Total
1. Hardware	**$25.00**	**$125,000**
2. Software & Materials	**8.33**	**41,667**
3. Inservice Education	**4.17**	**20,833**
4. Coordinators	**8.33**	**41,667**
5. Contingency	**4.17**	**20,833**

The figure that initially tends to be most interesting to school district administrators and computer coordinators is the money for hardware. What can one buy with $25 per student per year? The answer obviously depends upon the particular equipment being purchased. A recent (winter, 1984) ad in my town's local newspaper indicated one could purchase a 64K machine with one disk drive, printer and monochrome monitor at a retail price of $900. The ad was for a very widely sold computer system from a reputable local dealer. This, of course, was a special sale price. However, school districts that go out for bids can usually obtain a discount of approximately 30 percent off the list price. That level of discount would have brought the price of this particular equipment to under the $900 figure.

The $900 figure might be considered adequate for a low- to middle-priced microcomputer that has been on the market for a couple of years. You can expect that the machine quality that this amount of money can buy will continue to improve rapidly in the future. Many school districts are purchasing more expensive microcomputers. The price of such newer, more expensive models may well decrease 20 percent a year during the first few years they are available.

Now a couple of assumptions are needed. A typical school doesn't want a printer on every microcomputer, and it's likely the school will want some dual-disk systems. As a school obtains a quantity of machines, it is likely some will be networked using a floppy or hard-disk system. This may cut the average cost of a user station. Let us assume that the average cost of a user station will be about $900. Let's also assume that such systems will have a four-year life span, with maintenance costs averaging $100 per machine over the four years. Therefore, we can assume that $1,000 provides a user station that functions for four years and is then completely worn out. The hardware cost is $250 per machine per year.

A particular school district may decide to purchase computers costing much more than is assumed above. Such machines might have a longer life span, different maintenance costs and so on. For example, one might find that a machine whose initial cost is $1,600 will last five years, requiring perhaps $200 of repair and maintenance during that time. The average hardware cost per year is $360.

It is instructive to study an explicit example. We will continue the example based upon a machine costing $1,000 over a four-year time span. The first year's funds would purchase approximately one machine per 40 students. (This editorial was written in January 1984. At that time there was an average of approximately one machine per 120 students in the United States and Canada. The first year's hardware funds in the two-percent proposal would purchase about three times as many machines as were already in schools.) The second year's funds would bring the average to one machine per 20 students; the steady state situation in the fourth and subsequent years would be one machine per 10 students. This analysis ignores whatever computers a district might initially own.

An average of one machine per 10 students is equivalent to about a half-hour of machine time per student per day. If computers are going to have a significant impact upon our overall educational system, we should be able to see the beginning of the impact with this average level of computer usage.

This hardware analysis suggests that an average school district, by spending one percent of its budget every year for hardware, will eventually have about one microcomputer per 10 students. Very few schools have yet achieved such a ratio. If computer prices continue to decline, or if machines have a longer life span, then an even higher ratio will be achieved. Alternatively, if a district selects more expensive hardware, it will achieve a lower ratio of machines per student.

The same sort of analysis indicates that if a school district allocates two percent of its budget strictly for hardware, it will eventually achieve a ratio of one machine per five students. A hardware allocation of five percent of the annual budget leads to a ratio of one machine per two students.

The money allocated for software, manuals, books, films and related support material is substantial but may prove inadequate, as classroom sets of textbooks and expendable workbooks may be quite expensive. One way to analyze this is to look at various categories of instructional computing. The categories I use are learning/teaching about computers, learning/teaching using computers and learning/teaching incorporating computers. Each category requires differing amounts and types of software, support materials and teacher knowledge.

Learning/teaching about computers may require relatively little software beyond the language translators and operating system. It does require books, films and other media, and it requires quite knowledgeable teachers. (The suggested tradeoff between teacher knowledge and costs for hardware or software can occur in each type of computer usage.) Learning/teaching about computers is done in a self-contained classroom, with the instruction being done by a computer teacher. In our overall model, the cost of teachers is not included. Such costs are considered to be part of the ongoing costs of the school system.

Learning/teaching using computers (usually called computer-assisted learning) can require a substantial software library. A particular computer simulation, for example, might be used only once or twice per year. Currently the costs of such software are high and the total quantity of good software is still quite limited. We can expect a continued rapid growth in the availability of good computer-assisted learning software. We will probably find that vendors will make available multiple copies of software, or software for local networks, at quite good prices.

Learning/teaching incorporating computers requires changes in the content of the conventional curriculum. A typing course might become a word processing course, requiring word processing software and perhaps a typing tutor program. A bookkeeping course might be substantially changed by providing electronic spreadsheet and accounting software. A science lab might be changed by use of appropriate hardware and software for the on-line control of experiments and the collection and processing of data. A math course might require a substantial library of graphic, equation-solving and symbol-manipulation software.

A different way to view this expenditure category is that each machine will have $333 of software and other support materials. This is quite a bit if all of these materials have a long lifespan and can be used by a variety of students. For example, a single rental film might be viewed by many hundreds of students and a reference book may be useful for several years. By appropriate scheduling, a few copies of a particular historical simulation might be used by students in schools located throughout a large school district. A growing district-level lending library of commercial software might be supplemented by carefully screened public domain software. Of course, such a central library will need to be staffed. Such costs are considered to be part of the funds included in the two-percent figure.

The money for inservice education of administrators, teachers, support personnel and aides will allow for initial and continued growth in their knowledge and skills. If a district has not yet put much money into computer-related inservice education, the first year's expenditures probably need to be above one-twelfth of total funds. This can be done by drawing upon the contingency fund. Many districts have already provided such initial inservice computer exposure to all of their teachers and administrators.

It is important to realize that inservice education must continue beyond the initial effort. The level of knowledge needed when there is only one microcomputer per 120 students is quite different from what is needed when there is one microcomputer for every 10 students. At this level we could begin to see substantial changes in the content of current non-computer courses. This will require extensive inservice education as well as funds to support curriculum development and revision.

The funds and training effort need not be evenly spread among all educators. Likely it will prove desirable for each school to have a building-level coordinator with some release time from regular teaching duties. Alternatively, a building-level computer coordinator might receive a salary increment for handling these extra responsibilities. In either case the funds would come through the two percent allocation.

While all educators need an elementary working-tool level of computer knowledge, building-level coordinators will need substantially more knowledge as part of their jobs. They will be doing inservice education of teachers and administrators in their buildings. They will be training aides, helping in the acquisition of hardware and software, and doing other things requiring a high technical level of training in the computer field. Some of the inservice education funds could be used to facilitate this much higher level of training.

One use of some of the computer coordinator funds was mentioned above—to provide some release time for building-level computer coordinators. But consider the need for a coordinator (and a staff if the district is large) at the district level. In four years a 5,000-student school district will have about 500 microcomputer systems valued at approximately a half-million dollars. The district may have several hundred thousand dollars invested in software and other support materials. This is a substantial investment. A district computer coordinator will have a wide range of duties including supervising hardware and software acquisition, assisting in a large inservice education program, and working with curriculum committees to integrate computers into the curriculum.

The fifth category, the contingency fund, can be used for a wide variety of purposes. As stated earlier, it might be used to supplement teacher inservice monies, especially in the beginning, or for remodeling.

Funds could be provided for:

- Accessing large-scale data banks;
- Designing and implementing a narrow-band or broad-band network for the school district;
- Special-purpose peripherals such as videodisc equipment;
- Hardware and software for students to borrow for home use;
- Establishing a community (neighborhood) school to provide community access to instructional computing equipment.

Possible uses of the contingency fund seem endless.

The Two-Percent Solution provides an interesting model to explore certain aspects of the future of computers in instruction. Most important is the idea of a permanent commitment to a reasonable level of funding. Most school districts have not yet made this sort of commitment. They are purchasing equipment using entitlement funds, block grants, grants from foundations, money from parent-teacher organizations and so on. They are giving "one shot" teacher training workshops with little or no follow-up or opportunity for deeper training. They have not yet done the necessary planning for computers to have a significant and continuing long-term impact upon the overall content and process of education.

Two percent is a good initial goal. It is enough money to establish a solid program of instructional use of computers. However, two percent will probably prove quite inadequate over the long run. Perhaps a few years from now I will be writing an editorial on the five-percent solution. That is closer to the level of funding that will be necessary if we want to provide one microcomputer per two students, a good goal to aim at in the next decade.

Appendix B

Back to Basics

Honoring Basics

Reading, writing and arithmetic—the 3 R's. Some computer educators become so enamoured with computer potentials that they forget why the "basics" are so-named.

Reading provides access to information. A book is an inexpensive, easily portable vehicle for transmitting large quantities of information over time and distance. Reading provides access to quite a bit of the accumulated knowledge of the human race. Reading is also a form of entertainment.

Writing provides the materials to be read. Equally important, writing is an aid to the human mind as it works to solve a variety of problems. For example, writing provides temporary storage of ideas as I work out the order and details of a workshop or lecture I intend to present.

Arithmetic also serves two major purposes. Numbers can represent quantities or location, distance, time, area, volume and other measurements. Arithmetic (more generally, mathematics) provides a language to represent, store and access these types of information. As with reading and writing, quantifiable information can be transmitted over time and distance. The geometric theorems of Euclid are as valid today as they were two thousand years ago.

Arithmetic is also an aid to problem solving. If a problem can be represented using the notation and ideas of arithmetic, then one may be able to solve the problem using the accumulated knowledge and the tools of this field. The tools include operations such as addition, subtraction, multiplication and division; other tools include drawing diagrams and graphs.

As an educator, it is important that you understand the 3 R's. As a computer educator, it is important that you understand how computers interface with and possibly affect the 3 R's.

The role of reading and writing as aids in transmitting information over time and distance has been indicated. A number of other aids have been invented. The telegraph and telephone certainly revolutionized communication over long distances. Photographs and movies, radio and television, phonographs and tape recorders, computers and laser discs—all aid communication over time and/or distance. The telephone is particularly interesting. It takes some training to use a telephone. But what is mostly required is a level of speaking and listening skills that people can usually acquire without benefit of formal education. Thus, while formal training in use of telephones is required for some jobs, telephone literacy is not part of the school curriculum.

Right now computerized telecommunication systems, databanks, bulletin boards and teleconferencing seem rather esoteric to many. The suggestion is that learning to use such aids to communication is difficult and requires extensive formal training, even though using them is mostly a matter of reading and writing (typing). That is mainly true because such facilities are still relatively expensive and not readily available, and because the people-machine interfaces need additional work. Children who grow up with ready access to such facilities will find that they are easy and convenient to use. Reading and writing will remain basics, but they will be supplemented and extended by computerized aids to communication.

I want to make two additional points about inventions. First, each new invention such as radio or television broadens the scope of communication. It takes substantial training and experience to be a skilled radio broadcaster or television producer. But generally it takes little formal training to be a user of these new inventions. The knowledge and skill needed to use the inventions is decreased by the development of appropriate people-machine interfaces. One sees this in modern cameras and in television sets.

Second, some inventions actually decrease or substantially change the type of training and experience important to the basics of education. The typewriter has decreased the relative importance of being able to write very neatly and rapidly. It does take training to learn touch-typing. But elementary school children can learn to type, rapidly acquiring useful skills. As a second example, consider learning to use a card catalog and to search library stacks versus learning to use a computerized information retrieval system. The latter will eventually be an easier and a far more reliable means of securing desired information. Notice in both examples that reading and writing are necessary skills and that the usefulness of the skills is expanded by inventions.

Increasing the Power of Basics

We have also indicated that reading and writing are aids to organizing ideas. Consider what you do as you prepare to write a paper or prepare to give a lecture. Consider the nature of the notes you take during a lecture or a staff meeting. To me it seems clear that an easily portable word processor may satisfy some of the same needs. But for me, such a tool will never replace pencil and paper for doodling during an incomprehensible talk or a dull staff meeting. Moreover, pencil and paper remain an excellent tool for prewriting and other organizing processes.

And that brings us to arithmetic. A calculator can aid in addition, subtraction, multiplication and division. A computer can draw graphs, solve equations and carry out complicated symbol manipulations. But these things are meaningful and useful only if one has mastered the vocabulary, notation and methods of representing problems in mathematical form. Electronic technology is a wonderful aid to parts of arithmetic, and its ready availability suggests changes in the nature of mathematics education. There can be less emphasis upon routine manipulation and more emphasis upon higher level cognitive processes. But the need to learn vocabulary, notation, what types of problems can be solved and the representation of problems as mathematics remains. And so far, no computerized system approaches pencil and paper as an aid to organizing one's thoughts and trying to figure out how to represent or to solve a math problem.

Long Live Basics!

The point to be made with each of the 3 R's is the same. Computers do not decrease the value of reading, writing and arithmetic. But computers are an aid to accomplishing the underlying purpose of each of the basics. Thus, the ready availability of computers actually tends to broaden the scope/nature of each of the basics and thus places an additional burden on our educational system unless we change the system somewhat. I think that gradually computers will be assimilated into the definition of each of the three basics. Eventually the term "writing" will include keyboarding and use of a word processor. The term "reading" will include accessing information from computerized databanks. The term "arithmetic" will include making use of calculators and computers as aids to problem solving. And the basics will stay basic.

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3. Siegfried Engelmann and Douglas Carnine: *Theory of Instruction: Principles and Applications*, Irvington Publishers, Inc., 551 Fifth Avenue, New York, NY 10017, 1982. A substantial discussion of theory of instruction, mainly from a direct instruction viewpoint.
4. Robert Gagne: *The Conditions of Learning*, Holt Reinhart & Winston, 1970. This is a classical reference on learning theory. Gagne has published a large number of additional books and papers.
5. Robert Taylor, Editor: *The Computer in the School: Tutor, Tool, Tutee*, Teachers College Press, 1980. A collection of classical papers written by Alfred Bork, Thomas Dwyer, Arthur Luehrmann, Seymour Papert, and Patrick Suppes.

Periodicals

1. *SIG Bulletin*, International Council for Computers in Education. Four issues per year. The U.S. price is $10 per year for ICCE members. One section of this periodical is written for computer coordinators. Another section is for teachers of teachers. ICCE is starting a Special Interest Group for computer coordinators. It will begin its own newsletter in 1985.
2. *The Computing Teacher*, International Council for Computers in Education. Nine issues per year. The U.S. price is $21.50 per year. ICCE is the leading professional society for instructional use of computers in precollege education. Many of the editorials are of special interest to computer coordinators.

The International Council for Computers in Education (ICCE)

The International Council for Computers in Education (ICCE) is a non-profit educational organization with 15,000 Individual Members and 43 Organization Members.

ICCE publishes *The Computing Teacher* as well as many booklets for persons interested in the instructional use of computers at the precollege level. All ICCE publications emphasize teaching about computers, teaching using computers, teacher education, and the impact of computers on curriculum.

TCT includes regular features and columns such as Software and Book Reviews, Computers in the Teaching of English, The Logo Center, Computers in the Media Center, Computers in the Arts and Humanities, and Computers in Science Education. TCT emphasizes practical, in-depth articles that are useful for K-12 teachers. Back issues of *The Computing Teacher* are available. Several issues of TCT have been special theme issues:

Vol. 10 #3—Logo
Vol. 10 #6—Special Needs
Vol. 11 #5—Logo
Vol. 11 #7—Public Domain Software
Vol. 11 #8—Equity

ICCE has a substantial and growing professional outreach program. Five major components include:

1. **Organization Members.** Organization Members publish newsletters and/or journals, hold conferences and directly interact with their own members.
2. **Professional Staff.** ICCE has a professional staff who write, edit, participate in conferences, process orders, consult by phone or mail, etc.
3. **Ad Hoc Committees.** Such a committee recently created the "ICCE Policy Statement on Network and Multiple Machine Software" (see TCT, Sept. 1983). A committee is currently working on certification requirements for computer-using educators.
4. **Technical Liaison Committees.** These are small informal committees designed to interface between ICCE and the professional societies of other disciplines. Currently there are TLCs in math, science, English as a second language and school psychology.
5. **National Educational Computing Conference.** ICCE is one of the sponsoring societies for NECC. This year ICCE is responsible for three panels: Certification Recommendations for Computer-using Educators; Impact of ICCE Policy Statement on Network and Multiple Machine Software; Logo in the Schools: Are There Problems? (double session co-sponsored with the National Logo Exchange).
6. **Special Interest Groups (SIGs).** ICCE has taken the initial steps in organizing special interest groups to facilitate cooperation among computer educators with a specialized interest or set of needs. SIGS, along with a planned *SIG Bulletin*, will attempt to serve as a forum for educators to clarify roles, receive and exchange pertinent information, and establish and build professional identity. Four groups have been identified within the computers-in-education field as having new and challenging responsibilities:
   - Computer Coordinators. This SIG is for people who have building-level or district-level responsibility for computers in education.
   - Teachers of Educators. This SIG is for people who develop and teach courses and workshops for inservice or preservice educators.
   - Administrators. This SIG is for school administrators who need considerable computer knowledge to make effective decisions about school management and the integration of computers into the curriculum.
   - Special Educators. This SIG is for educators and parents involved in the education of students with special needs.

Initially, one *SIG Bulletin* is being created to serve all the newly emerging SIGs. Eventually, individual SIG publications will replace this combined *SIG Bulletin*.

The *SIG Bulletin*, a quarterly publication, will carry information about the SIGs that are now forming. It will contain topics of interest to each SIG with a focus on:

- Articles of immediate importance and usefulness
- Surveys of the research
- Editorial comment to spark debate
- A forum for question/answer and the sharing of ideas

The first issue will be available May 1984. A special introductory issue is *available free upon request. This special preview issue is 24 pages in length and contains subscription information for the regular issues.*

Now Available—Computing in the Social Studies Classroom

This new ICCE booklet discusses the roles of educational computing that apply to social studies, how to locate and evaluate computing materials for social studies as well as the role of social studies classroom computing within a school's instructional program. The authors are Allen Glenn, Professor of Curriculum and Instruction at the University of Minnesota; and Don Rawitsch, Director of User Services for the Minnesota Educational Computing Consortium (MECC).

Preview Guide Now Available from ICCE

The *1984 Educational Software Preview Guide* is a list of favorably reviewed instructional microcomputer software for K-12 classroom use. It is designed to assist educators in locating software for preview; it is not intended to endorse these products for purchase without examination.

The *Guide* was developed by the Educational Software Evaluation Consortium, representing 27 organizations involved in computer education throughout North America. The selection of titles in this guide was based on critical evaluations conducted by the participating organizations and on discussion among the Educational Software Evaluation Consortium representatives who attended the 1984 California Software Evaluation Forum. Reviews published in professional journals were also considered. 8½x11, 50 pages, $5.

Logo in the Classroom

Logo in the Classroom is a collection of activities designed by Shirley Torgerson, an inservice and classroom teacher who takes Logo beyond "playing Turtle" and integrates it into the elementary curriculum. Based upon inclass experiences and expanded with suggestions from other Logo-using teachers, 20 complete lesson plans have been written for use in single-computer classrooms at the 3-6 grade level. The session guidelines encourage group-oriented activities as well as individual student exploration. Logo dialects covered are Terrapin (MIT) for Apple and Commodore 64, LCSI for Apple and Atari, Texas Instruments Logo and Radio Shack Logo. 8½ x 11, 202 pages, $13.

Some Special Offers from ICCE

ICCE Mini-subscription. A special 4 issue for $5 mini-subscription is available to teachers leading workshops, inservice or preservice courses of at least 15 people. Not a regular ICCE Membership, this 4 for $5 offer includes *either:*

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For orders, write the International Council for Computers in Education, University of Oregon, 1787 Agate Street, Eugene, OR 97403. (503) 686-4414.

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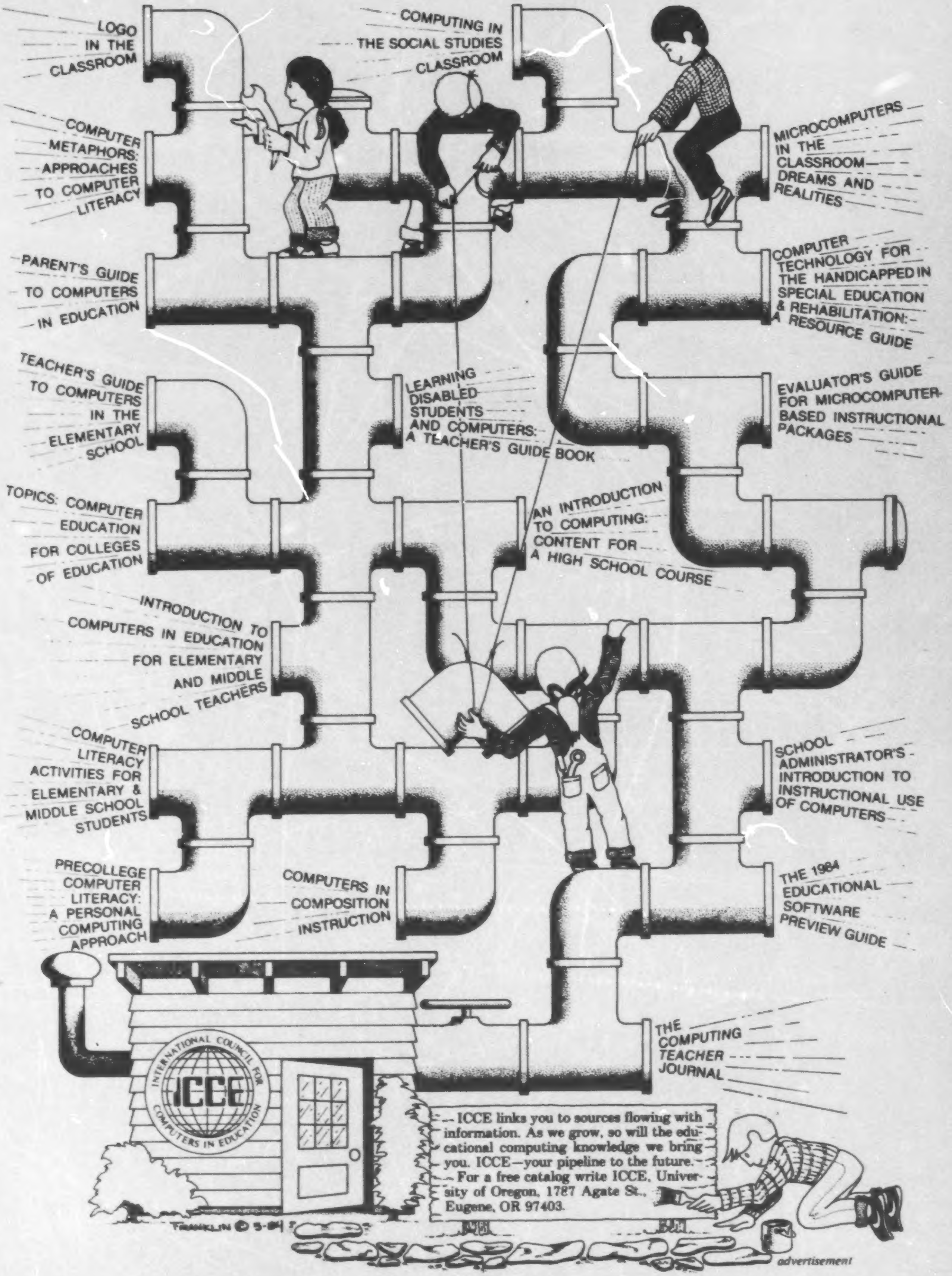
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